

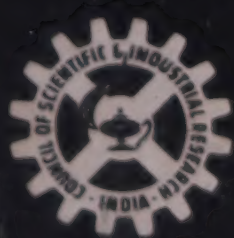
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CBRI's School Building Research Benefits the Community

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There is an urgent demand for a large number of school buildings in the country due to the rapid growth and expansion of primary education. The increase in the school-going population calls for large scale construction of school buildings throughout the country, especially in the rural areas. Financial resources being meagre, economy in the cost of construction of school buildings is of cardinal importance to the success of the education programme.

The Central Building Research Institute (CBRI), Roorkee, took up research on school buildings with the object of providing design data on functional and physical requirements and of studying methods of cost reduction in the planning and construction techniques. The research has shown promising results, making it possible to obtain substantial reductions in the cost of school buildings through rational use of space, analysis of costs and improved construction and design techniques.

Low-cost school buildings: In Uttar Pradesh there are nearly 63 000 primary schools; more than 50% of the schools have no buildings of their own. In addition, about 25 000 primary schools are expected to be opened during the next five years. This would raise the number of school buildings to be constructed to about 60 000 in the next five years. In October 1971, the U. P. Government organized a seminar on Cost Reduction in School Building

at CBRI. Subsequently, an inter-ministerial officials meeting held at Lucknow suggested to CBRI to develop a prototype and to provide technical guidance and supervision in the construction of 12 prototype school buildings in the districts of Lucknow, Unnao and Rae Bareilly. The institute worked out a three-phased plan and a prefabricated system-built construction. The first phase of this plan costs Rs 8500 per school.

Simultaneously, the U.P. Government has decided to construct primary school buildings in large numbers in accordance with the plans and construction techniques developed by CBRI, and have approached the institute to render technical assistance to the Zila Parishads in the construction of the schools. The institute has accepted the challenge since it provides a good opportunity to apply one of its researches into mass construction programme and carries it even to the remote rural areas. The CBRI design for these schools uses prefabrication for roofing and, in some cases, for foundations and columns supporting the roof. With this system of construction it has been possible to complete one school in as short a time as three weeks. It is seldom that building research has been applied on such a large scale in such a short time.

The entire programme of construction consists of about 5500 primary schools in the rural areas of 51 districts of the state. The average esti-

mated cost of each school building is Rs 8500 and the total cost is of the order of Rs 5 crore. With conventional design and methods of construction the cost of each school will be 20-30% higher and time taken for construction will be at least twice.

In the final stage the school consists of four class-rooms, a sheltered space, the head-master's room, cooking space for mid-day meals and a urinal with well landscaped and developed school site. Each class-room has been designed to provide space for 40 children and to provide adequate chalk-board, storage and display areas. Proper lighting and ventilation have also been taken care of. Built-in cupboards have been provided for storage. These cupboards also enable the village teacher to use them for overnight stay in the school. The first phase of the scheme consists of two class-rooms, a cooking space and a urinal. This is estimated to cost Rs 8500. The plan has been so developed that each phase can be added as and when finances are available.

The construction scheme consists of RCC prefabricated footings, columns, doors and window frames, chhajjas, lintels and roofing units. The roofing units are both for flat and pitched roofs. The scheme has been developed after considering the volume and type of skilled labour available in rural areas. Important features of the scheme are minimum number of standard components, simplified casting method, minimizing the use of skilled labour, lightweight individual components which can be handled by manual labour

and simplified joint details and erection methods. The scheme provides a skeleton structure first. Walls, windows and doors can be added later with locally available materials. This also encourages community participation by way of labour and materials.

The manufacture of the prefabricated components is being organized at district headquarters or at places covering schools within a radius of 15-20 miles. These components will be prepared under the supervision of skilled personnel and will be carted to the school sites. Their sizes and weights are such that it is possible to transport them in bullock carts also.

Employment potential: Besides providing maximum number of primary school buildings with the limited financial resources, the project will provide employment not only to engineers and technicians but also to unskilled village labour. According to a rough estimate, the project will provide employment opportunity of the magnitude of about 23 lakh man-days of which about 6.71 lakh man-days will be for skilled workers and about 16.22 lakh man-days for unskilled village labour. In terms of wages, this would amount to about Rs 1.10 crore.

Community participation will be encouraged in the construction programme, which will open up employment opportunities to villagers. This is proposed to be achieved by providing the skeleton structure in the form of footings, precast columns, roof trusses, purlins or beams and slab components, and by encouraging the local community to furnish labour to put up the skeleton structure and subsequently fill the walls and floors.

The scheme thus serves two major objectives: (i) to provide greater number of primary school buildings in much less time within the avail-

able financial resources; and (ii) to provide employment opportunities to engineers, technicians, skilled labour as also unskilled village labour.

Deputation Report: Shri M. M. Shirsalkar

Shri M. M. Shirsalkar of the Regional Research Laboratory (RRL), Hyderabad was deputed for five weeks (11 Sept. to 15 Oct. 1972) to Bulgaria under the first Protocol of Indo-Bulgarian Joint Commission for Science and Technology for training in the production of lacquers, dyes, flexible and plastic coatings durable in tropical climate, and also anticorrosive coatings for metals in hot climatic conditions. Shri Shirsalkar has been working at RRL, Hyderabad on anticorrosive paints and pigments.

A programme to visit the Central Scientific Research Institute for Technology of Machine Building, Sofia and factories producing lacquers, paints, pigments and plastics at Sofia, Varna, Russe and Burgas was arranged during the deputation period.

Work done at the Institute is concerned with various aspects of metal corrosion, its prevention by metallic and organic coatings and the evaluation of protective life of organic coatings.

The Electrolytic Coating Division of the Institute deals with the electro-deposition of metal coatings such as zinc, cadmium, aluminium, lead and chromium, on steel and other metals and alloys. These coatings have the advantage of bright surface, decorative as well as protective properties and also need no polishing. Stresses created during the electro-deposition of metals, particularly in case of nickel coatings, are being studied with respect to thickness, effect of brighteners and other electrolytes present in the electrolytic

bath. It has been found that the organic brighteners, in requisite quantities, help reduce the internal stresses.

One of the problems being studied is the brightening of cadmium coatings. Though a reasonable amount of success has been obtained in this direction, the coatings lack the lustre of the nickel coatings. Cadmium coatings are found to be more resistant to corrosion than nickel coatings, particularly in a salt-laden atmosphere. To increase the corrosion resistance, nickel and cadmium coatings are passivated by chromate solution.

Laboratory evaluation of the coatings consists in subjecting the coated panel to humidity corrosion, and salt spray tests. The method is similar to that specified in the Indian Standard Specification. The conventional method of exposing the coated panels to marine and industrial atmospheric conditions is also being used.

In the Plastic Coatings Division the application of coatings by flame spraying and fluidized-bed technique was demonstrated. The materials to be coated are grit-blazed and cleaned or phosphated to increase the adhesion of plastics. Both polyethylene and polyvinyl chloride give satisfactory adhesion to mild steel, and the coatings, particularly polyethylene coatings, are found to resist sea-water for long a time (two years).

Increasing use is made of plastic such as high impact resistance polystyrene, PVC and acrylonitrile polymers to replace such buildings fittings as showers, reflectors, tubes and door knobs, and bulbs. For decoration and increased protection the are coated with a metallic coating. The steps involved in metallization of a plastic are (i) cleaning and etching of surface, (ii) sensitization and activation of the surface, and

(iii) copper or nickel plating to form the base to be used for electroplating in the usual manner. Experiments were carried out to have nickel coatings on polystyrene, PVC and polypropylene. It has been found that nickel adheres better to polypropylene than PVC.

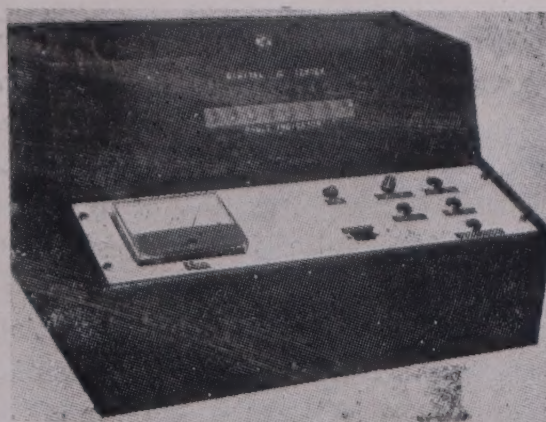
One of the Divisions is engaged in vacuum plating of aluminium to plastics. Polystyrene articles such as buttons and knobs are first cleaned and given a coat of metallic lacquer or epoxy lacquers and cured at 60 ° C for 1 hr. The dried articles are coated with aluminium in a special apparatus at room temperature under vacuum. The coating is uniform and has a thickness of 30 μ . The coated articles are finally given a coat of air drying or epoxy lacquers. Epoxy lacquers are found to cause softening of the plastic and hence only air drying coatings are preferred.

Shri Shirsalkar also attended the International Conference on Galvanizing at Sofia (5 Oct. to 8 Oct. 1972).

Automatic Static Tester for Digital ICs

A static tester for digital integrated circuits (ICs) of the 7400 series has been developed by the National Aeronautical Laboratory (NAL), Bangalore. As integrated circuits are being used increasingly in all types of electronic equipment, there is a great demand for an automatic IC tester.

While fabricating digital systems using a large number of ICs it is necessary to test every chip before wiring it in circuit. It would be impossible to test them one by one for worst case input, output conditions, turntable verification and short circuit between pins, unless it is done using an automatic tester. The tester therefore is a handy tool in the manufacture of digital equipment like computers, calculators, and data systems.



Automatic static tester for digital integrated circuits developed by NAL

A sequence generator with an internal clock in the tester provides the various combinations of '0' and '1' levels to the reference and test ICs, with only one bit changing at a time, so that the uncertainty associated with two or more bits changing at a time does not arise. Different lamps are driven to indicate short circuit between pins, functional failure or good performance of the test IC.

For each type of IC a programmer card carrying an IC socket could be plugged into the connector on the front panel and a large number of the same type could be tested in a very short time, about 1 s per device. Considering the variety of tests that could be performed on the test chip the automatic static tester is inexpensive.

The Wealth of India : Raw Materials Vol. XI

Volume IX of the Wealth of India. Raw Materials (Rh-So) has been published by the Publications & Information Directorate, New Delhi. This 472-page volume contains 174 articles: 164 on plant genera, 5 on animals and animal products, and 5 on minerals. Some of the important entries are: *Ricinus*, *Rosa*, *Saccharum*, *Santalum*, *Saussurea*, *Sesamum*, *Setaria*, *Shorea*, *Solanum* and *Sorghum* among plant entries; Silk and Silkworms among animal entries; and Road Metal, Salt

and Sillimanite among mineral entries.

Wealth of India is an encyclopaedia of the economic products and industrial resources of India and is brought out in two series—(i) Raw Materials and (ii) Industrial Products. Compiled by a body of experts with the collaboration of specialists in various fields all over the country, the Wealth of India serves as a ready reference manual for students, scientists, industrialists, and others interested in the topics covered in this treatise.

The vegetable products, which cover more than 80% of the text in all volumes, are dealt with under the botanical names of the plants, arranged in alphabetical sequence of their generic names; the minerals and animal products are given under their English names with their scientific equivalents. Names in Indian languages, common English names and trade names of plants, animals and minerals and their products are provided. Data regarding area and production, and export and import are provided. Regarding minerals, their occurrence and distribution in the country and modes of exploitation and utilization are given. The articles are well illustrated.

Like the earlier volumes, volume IX gives an account of the raw materials of vegetable, animal, and mineral origin available in the country. The entries cover animals and animal products; beverages; dyes & tans; foods & fodders; fruits & nuts; gums & resins; medicinal plants; minerals; spices, flavourings, and natural perfumes; narcotics, fumitories & masticatories; timbers and other forest products; and vegetables.

Bharat ki Sampada: Prakritik Padarath

The second and third volumes of *Bharat ki Sampada: Prakritik Padarath* have been brought out by the Publications & Information Directo-

rate, New Delhi. The publication is the Hindi version of the encyclopaedic publication, *The Wealth of India: Raw Materials*, being published by the directorate.

The second volume includes 650 titles covering the Hindi alphabet *ka*. The 446-page volume covers 93 genera and 450 species and is illustrated with 14 coloured plates and 110 photographs.

The third volume, covering the Hindi alphabets from *kha* to *na*, includes 501 titles (225 genera, 260 species, seven titles relating to animals and 9 to minerals). The 450-page volume is also illustrated profusely.

The articles give an account of the raw materials of plant, animal and mineral origin. The plant products are dealt with under the botanical names of the plants and are arranged in the alphabetical sequence of their generic names while the minerals and the animal products are given under their Hindi names with scientific equivalents. Names in different Indian languages, common names and trade names of plants, animals and their products have also been given.

As regards plant products, those parts which are of economic importance are adequately dealt with. In the case of important crops, information in regard to the origin, distribution, evolution of cultivated types and methods of cultivation, harvesting and storage is given in detail. Up-to-date data regarding area and production and export and import of all major economic products have been provided. Regarding minerals, their occurrence and distribution, modes of exploitation and utilization have been described.

Important articles included in Vol. II are: *Camellia* (Tea), Insects and Insect Pests, *Coffea*, Coal, Quartz and Silica, Fungi, Glass Sand, *Corchorus* (Jute), *Carthamus* (Kusum), Crabs,

Earthworms, *Cajanus* (Arhar), *Can-nabis* (Bhang), *Capsicum*, *Carica* (Papaya), *Cassia* (Sanay), *Cocos* (Coconut), Cobalt, Corundum, *Colocasia*, *Chrysanthemum*, *Crotalaria* (San), Chromite, *Quercus* and Alkaline Soils and Lakes.

Important articles included in Vol. III are: Mineral Springs, *Garcinia*, *Gossypium* (Cotton), *Grewia*, Graphite, Glycine (Soyabean), Limestone, Lizards, Gypsum, *Juglans* (Akhrot), *Jasminum*, Leeches, Prawns, Shrimps and Lobsters, Locusts, *Dioscorea* (Yam), *Diospyros* (Tendu), *Daucus* (Carrot), *Datura*, *Dolichos* (Bean), *Dalbergia*, *Dendrocalamus* (Bamboo), Dolomite, Garnet, Nickel Ores, and *Nicotiana* (Tobacco).

Metric system of weights and measures, Arabic numerals and English systems of chemical symbols and equations have been adopted. Technical terms approved by the Commission for Scientific & Technical Terminology for Hindi have been used. The titles of all the major botanical species have been given in Hindi followed by their names in English and their Latin pronunciation in Hindi. All the biological Latin names used in the description of species have been compiled in English at the end to facilitate such readers as would like to have specialized knowledge of the subject from standard English works. Adequate literature references to the sources of information are given at the end of the paragraphs.

An index incorporating all the names in Indian languages is also included.

Indian Journal of Marine Sciences

The first issue of the *Indian Journal of Marine Sciences*, a half-yearly being published by the Publications & Information Directorate of the Council of Scientific & Industrial Research in association with the Indian Nation-

al Science Academy, New Delhi, has just been released. This 94-page issue (June 1972) contains 13 papers covering the various areas of marine sciences. This half-yearly periodical is devoted to research communications (full papers and short communications) pertaining to the following facets of marine science research: biological oceanography; physical oceanography; geological oceanography; and chemical oceanography.

The annual subscription to the journal is Rs 15.00 (£2 or \$5.00) and a single copy is priced Rs 10.00 (£1.2 or \$3.50). Subscription orders may be addressed to: The Sales & Distribution Officer, Publications & Information Directorate (CSIR), Hillside Road, New Delhi 110012.

Suggested Areas of Research Relevant to R&D Programmes of CSIR Laboratories

In continuation of the compilation entitled 'Current Research Projects in CSIR Laboratories—1972' brought out by the Indian National Scientific Documentation Centre (Insdoc), New Delhi, a companion volume titled 'Suggested Areas of Research Relevant to R & D Programmes of CSIR Laboratories' has been brought out by Insdoc. As the title indicates this latter compilation provides guidelines to investigators in university departments and higher institutes of learning (such as IITs) for selecting research projects to be supported by CSIR funds. The areas of work listed or suggested in the compilation are based on the suggestions received from the directors of national laboratories and have relevance to the R & D programmes of the laboratories.

The publication is divided into three sections: (i) classified list of projects, (ii) areas listed by laboratories, and (iii) alphabetical list of projects. In the classified list of projects, the projects fall under the fol-

lowing main disciplines (UDC) : Physics and mechanics, Chemistry, Geology, Anthropological and biological sciences, Botany, Medical sciences, Engineering, Agriculture, Management, organization of industry and commerce, Chemical technology, Manufactures, and Building industry. A subject heading index is also provided in the 72-page (demy 4to) publication.

National Metallurgists' Day Awards

Sarvashri Kunda Singh and M.V.P. Menon of the Central Fuel Research Institute, Dhanbad and Shri P.V. Vasudeva Rao of the Central Electrochemical Research Institute,

Karaikudi are among the recipients of the tenth National Metallurgists' Day awards. The awards were presented at a function held in New Delhi on 14 November 1972.

Sarvashri Singh and Menon received the award for their contributions in coal carbonization, particularly for the development of the new design of beehive oven in which the coking time is reduced to 28 hr from 72 hr, and hence increasing productivity by 250%. Shri Rao's award was for developing (i) suspension electrolysis to recover zinc from galvanizer's residues, (ii) a direct reduction technique for producing metal powders, and (iii) a method for estimating non-stoichiometry of oxides.

PROGRESS REPORTS

CMRS Annual Report : 1971-72

The annual report of the Central Mining Research Station (CMRS), Dhanbad for 1971-72 shows that the research work has been streamlined to suit the immediate and long-term requirements of the mining and allied industries. The 220-page report records the progress in R & D activities of the laboratory under the following five disciplines: Mine technology; Mine safety; Mine engineering; Mine health; and Mine air pollution. Sixty-four projects in all were investigated, including 16 projects taken up during the year; work on 20 projects was completed.

A detailed study of the effectiveness of bolting for roof support was carried out in two mines. Roof bolt anchorage investigations were completed in eight mines. Investigations on strata movements were carried out in one longwall face of a pyrite mine, in six longwall faces of one colliery and in another colliery where partial extraction was experi-

mented on as the final operation. The loss of coal associated with bord and pillar workings was investigated in six collieries including two new collieries. At the instance of a colliery management, the capacity of the existing transport system of a coalmine was assessed. Investigations into the safety of the railway line over workings in a colliery were conducted by measuring horizontal and vertical surface movements in relation to underground workings. The stability of underground dams and a dyke zone at a colliery was investigated. At the instance of the National Coal Development Corporation, the future working of two seams in Silewara area by longwall caving was investigated. Two equivalent material models were prepared and the movements of strata at different points in relation to underground workings were studied. Information about the strata movement in a colliery being worked with pneumatic stowing was collected. Work on a problem referred to by

the Coal Board regarding the adjustment in the stock of sand in the J-K bicable No. III was completed during the year. As many as 884 sand samples were analyzed for moisture content and 390 bulk density tests were made. Investigations on the use of coir matting for sand stowing were conducted in a coalmine. Various aspects of improving the efficiency of hydraulic stowing plants were investigated in four mines. The laboratory's investigations helped the mine managements concerned to increase the rate of stowing up to 200%. The suitability of boiler ash, pyrite cinder and the sand of a river was investigated for use as stowing material. Investigations carried out on problems of blasting in an iron ore mine led to savings in drilling meterage and overall economy in the entire drilling and blasting operation.

Twenty-seven flame-proof electrical equipment (17 indigenous) were tested and found satisfactory. Testing of various circuits and electrical units for intrinsic safety was carried out on five items of indigenous origin. Five multi-shot exploders, manufactured indigenously for use in gassy mines, were tested for performance and safety. Check tests were carried out on five indigenous exploders for output characteristics and performance requirements. At the request of manufacturers of explosives, tests on 9 samples of explosives were carried out to find their certification for inclusion in the various groups of permitted explosives. As many as 1434 gas samples were analyzed. Samples of stone dusts and mine dusts (44), ores and minerals (7), steel (8), alloys (4), alum (39), coal (14), water (12), oil and varnish (22), and magnetite (14) were analyzed. Field studies on mine fire were conducted in a pyrite mine and two coalmines. Ventilation surveys were carried out in two gold mines and recommenda-

tions for effecting improvements in the existing ventilation conditions in respect of A/71 mine were made to the mine management. Thirty-three anemometers and three velometers were calibrated. The performance of 82 caplamps issued from the lamp rooms of two coalmines was investigated. Technical assistance was rendered to the mining industry, Directorate General of Mine Safety, NCDC and manufacturers of miners' safety equipment by investigation and testing of miners' safety lamps and components, bulbs for miners' caplamps, miners' safety helmets and methanometers, and by calibration and servicing of methanometers.

Studies in mine engineering included the testing of wire ropes (848 samples including 26 imported) in order to evaluate the influence of service conditions on rope properties. One hundred and twenty-eight pins, 270 cage shackles, 38 cage suspension chains, 23 distribution plates, 7 rope cappelles, 31 winder shafts, 19 safety hooks, 16 bridle chains, and 11 apex plates were tested by non-destructive testing methods, viz. magnetic particle flaw detection, ultrasonic flaw detection and radiography. The detection of manufacturing flaws enabled the manufacturers to improve the quality of product. Five steel friction props, three rigid props, one friction chock, 25 load cells and five link bars were investigated and tested for use as mine roof support materials.

The Mine Health Group continued the study of the dust problem in coalmines and associated diseases. Studies on the physiological evaluation of mine work in regard to energy expenditure in different mining operations were completed. Nine samples of soda lime were investigated, tested and reported for use in self-contained breathing apparatus.

Three lung samples with different

occupational history of deceased miners, ultra-surface features of coal samples from two seams of Jharia coalfield and samples of airborne dust collected during undercutting operation in different seams and under different conditions in a coalmine of Jharia coalfield were studied under the electron microscope. Estimation of dust loading of exhaust gases from kilns, cement mills, coal mills and coal driers of four cement works was completed during the year.

Four patent applications were fil-

ed, one each in respect of (1) apparatus for testing the mechanical strength of glass shells of finished miniature electric bulbs of miners' caplamps, (2) design of gas detector feeder, (3) process for the preparation of hydrocarbon vapour detector tube, and (4) new method of grouting roof bolts. Thirty-eight research papers were published.

The revenues accruing to the laboratory from its technical services amounted to about Rs 5.80 lakh during 1971-72.

PROCESSES & PRODUCTS READY FOR COMMERCIAL UTILIZATION

DC Electrical Dynamometer

Electrical dynamometers are essential instruments which absorb drive and measure mechanical power on rotating shaft. The Central Mechanical Engineering Research Institute (CMERI), Durgapur, has developed three types of dynamometer: (i) 4 hp at 300° rpm; (ii) 16 hp at 1500 rpm; and (iii) 66 hp at 1000 rpm. Dynamometers of any other range can also be designed.

The direct current electrical dynamometer consists of a dc generator with annular field frame. The field frame, or the stator, is supported radially on two ball bearings on pedestals instead of being rigidly bolted to the base, permitting the machine to swing.

When the armature of the dynamometer is rotated by the engine it exerts a torque on the field frame and tends to carry the frame along with it. Current is induced in the armature of the generator which is dissipated on a load resistor. A level arm extending from the field frame is connected to a spring balance, which counterbalances the rotation of the field frame and measures the force exerted by the frame. The

force exerted by the frame through the lever arm is equivalent not only to the electromagnetic reaction between the armature and the field frame, but also to the air resistance or windage, commutator brush friction and the armature bearing friction. The only factor which is not taken into account by the reading of the dynamometer scale is the friction of the ball bearings supporting the field frame, which, however, is negligible.

The horse power of the machine under test is calculated by the formula: $P = WN/C$, where P is the power developed, W is load in kg, N is speed in rpm, and C is the dynamometer constant.

For the sake of simplicity in calculation, the dynamometer constant is adjusted to a value of some even number, such as 1000 or 2000, by adjusting the length of the lever arm.

In the same way, by using the dynamometer as a motor, driven machines can be tested.

Electrical dynamometers have several advantages over other types:

(1) It is easy to convert from a dc machine. (2) Very accurate measurements are possible. (3) Load control for a long duration without

the need for an operator to check the load constantly is possible due to better stability. (4) Because the engine is started by switching on a dc supply, the need for manual aid or battery for starting is eliminated. (5) The friction horse power of the engine can be found by motoring technique. (6) The horse power of driven machinery such as pumps and compressors can be found by running it as a motor.

Nine prototypes ranging from 3 to 66 hp have been fabricated and are in regular use in the laboratory.

At present the device is being imported and it is expected that with the availability of indigenous dynamometers the annual demand for the device would be around 100 units. A new production unit for this project would be uneconomical: any firm having facilities for the production of such equipments could take up production of the dynamometer.

All the materials required for the production are available indigenously.

The estimated market price of a complete unit with controls would be Rs 12 000 for a 4 hp model, Rs 18 000 for a 16 hp model, and Rs 35 000 for a 66 hp model.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Barium Sulphate- X-ray Grade

Barium sulphate is widely used in medicine — as an opaque contrast medium in X-ray therapy and as an anti-diarrheal and demulcent powder. Recently, it has also been used in the manufacture of intra-uterine contraceptive device. The material is being imported at present.

The Regional Research Laboratory (RRL), Hyderabad, has developed a

process for the production of X-ray grade barium sulphate. Barium chloride is reacted with sulphuric acid to obtain a precipitate of barium sulphate. The precipitate is washed, filtered, dried and ground to the required particle size. The work has been carried out in the laboratory on a 40 kg per batch scale. The product obtained conforms to B.P. and has been found acceptable by consumers.

Barium chloride and sulphuric acid are the raw materials, and these are available indigenously.

The major equipment required for the process are: acid feed tank, reaction vessel, basket centrifuge, tray drier, ball mill, and vibrating screen. All these items of equipment are available indigenously.

CSIR SUPPORT TO RESEARCH

New Schemes

Life-History, Biology and Morpho-taxonomic Aspects of Mites

Very little work has been done on the biology and life-history of the Indian mites so far; detailed life-histories of only a few species have been worked out. A number of species recorded from sugarcane, cotton and citrus are still unnamed. Thus, there is a need for a detailed study of the taxonomy, bionomics, morphology and control of mites. A new CSIR research scheme with this objective has been granted to Dr M. P. Singh (principal investigator) of the Department of Zoology, L. S. College, Muzaffarpur. It is proposed to carry out investigations on the biology, life-history and morphotaxonomy of the species of mites, particularly those associated with lichi, chillies, lady's finger, guava and sugarcane.

Effects of Chemosterilants on Gonads of *Dysdercus cingulatus*
Studies on the effects of certain chemosterilants on insects like house-

It is advisable to have the unit for the production of X-ray grade barium sulphate as an adjunct to a plant which manufactures drugs and fine chemicals. In such a case no separate land and building will be required. For a plant of 80 kg per day (1 shift) capacity, the estimated total investment is Rs 2.75 lakh (Rs 2.22 lakh as fixed capital on plant and machinery; and Rs 53 000 as working capital). The cost of production has been worked out at Rs 6.25 per kg. The prevailing market price of X-ray grade barium sulphate is about Rs 9 per kg.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

flies and mosquitoes have been confined to the fecundity and hatching of eggs in different generations. The effect of such chemicals on insect pests of agriculture have not been studied. Further, the effects of chemosterilants on the development and maturation of the ova and spermatozoa have been observed only in the case of housefly. Such investigations would be useful in determining the process of sterility in insect pests. In a new CSIR research scheme granted to Dr M. A. Khan (principal investigator) of the Department of Zoology, Aligarh Muslim University, Aligarh, it is proposed to study the effects of some modern chemosterilants on the reproductive physiology of *Dysdercus cingulatus*, a cosmopolitan pest of cotton and other plants of the Malvaceae family. To begin with, the effect of two chemosterilants, viz. triphenyl tin chloride and TEPA, will be investigated.

Primary Production in Srinagar
Exploitation of untapped food resources from different water bodies

assumes tremendous importance in view of the increasing demand for food throughout the world, particularly in the underdeveloped and developing countries. Measurement of organic production in inland waters would provide basic knowledge for tapping new sources of food. Much work has been done on the primary productivity of lakes in the different parts of the world, but in India, this subject has not been studied extensively. Some work on ecology of Kashmir lakes has been done by Dr V. Kaul, of the Botany Department, Kashmir University, Srinagar and Dr D. P. Zutshi of S. P. College, Srinagar. The object of a new CSIR research scheme granted jointly to Dr Kaul (principal investigator) and Dr Zutshi (co-principal investigator) is to assess the contribution made by phytoplankton, macrophytes and periphyton towards the production in Srinagar lakes. This study would help in increasing the fish crop in these lakes.

Physiological and Ecological Effects of Naturally Occurring Factors of Indian Arid Zone Plants

Plant growth and development is a function of external factors, such as temperature, light, mineral nutrition and atmospheric carbon dioxide, and of internal genetical factors, the efficiency and level of enzymes, and the balance of chemical growth regulators; the growth and development of plants is also influenced by other plants. Many of the substances which occur in plants, especially compounds leached from leaf litter into the soil, affect germination and growth at relatively low concentrations. In India, no work has yet been initiated on the interaction of plant species inhabiting arid zone, and information pertaining to the characterization and ecophysiological effects of naturally occurring growth factors found in desert plant is scanty.

Under a new CSIR research scheme granted to Dr (Miss) Kamal Mohnot (principal investigator), of the Department of Botany, University of Jodhpur, Jodhpur, it is proposed to study the physiological and ecological effects of naturally occurring growth factors of Indian arid zone plants. The toxic principles in some selected plants will be characterized and allelopathic implications of these principles on growth and development of selected crop plants will be investigated.

Structure and Productivity of Grasslands around Ujjain

Grasslands play a very significant role in the economy of rural areas. Madhya Pradesh is full of grasslands, and around Ujjain particularly there are a number of large grasslands. It would therefore be of considerable practical value to work out the productivity of these grasslands under different conditions. The study of the effect of grazing of various intensities will help in proper management. In a new CSIR research scheme granted to Dr L. P. Mall (principal investigator) at the School of Studies in Botany, Vikram University, Ujjain, it is proposed to study the structure and productivity of grasslands around Ujjain.

PATENTS FILED

32631: UK; 72-31415: France (corresponding to Indian Pat. 133791): Improvements in or relating to the manufacture of cyclohexanone oxime from cyclohexanone, V. S. S. Rao, K. W. Gopinath & M. S. Iyengar—RRL, Jorhat.

398/72: The determination of acoustic anisotropy, Y. V. Ramana—NGRI, Hyderabad.

481/72: Improvements in or relating to the formation of lead dioxide on lead and its alloys in chloride medium, H. V. K. Udupa & K. C. Narasimham—CECRI, Karaikudi.

482/72: A process for the simul-

taneous production of red oxide of iron and sodium sulphate, T. P. Prasad & B. R. Sant—RRL, Bhubaneswar.

584/72: A process for the reduction of phosphorus content from high phosphorus manganese ores by selective leaching, S. B. Kanungo & B. R. Sant—RRL, Bhubaneswar.

609/72: A process for the production of *p*-toluic aldehyde and *p*-toluic acid from toluene, B. Subrahmanyan, P. V. Krishna, K. W. Gopinath & M. S. Iyengar—RRL, Jorhat.

610/72: Improvements in or relating to inhibition of corrosion by natural waters in cooling systems, K.S. Rajagopalan & (Miss) K. Venu—CECRI, Karaikudi.

661/72: A process for upgrading the powdery iron oxide (blue dust), T. P. Prasad & B. R. Sant—RRL, Bhubaneswar.

877/72: Improvements in or relating to the production of matrix board, N. C. Nandi, C. N. Saikia, B. P. Chaliha & M. S. Iyengar—RRL, Jorhat.

1079/72: A vertical deflection coil winding machine, I. J. Singh & J. P. Raina—CEERI, Pilani.

1089/72: A process for the demineralization of natural or beneficiated graphites, B. K. Mazumdar—CFRI, Dhanbad.

1225/72: Improvements in or relating to mesatechnique for semiconductor device, R. P. Gupta & J. P. Pachouri—CEERI, Pilani.

Science & Technology of Sponge Iron and its Conversion to Steel : Symposium

The symposium on Science and Technology of Sponge Iron and its Conversion to Steel [CSIR News, 22 (1972), 152] will be held from 19 to 21 February 1973 at the National Metallurgical Laboratory, Jamshedpur. Visits to steel plant and R & D organizations will be arranged on 22 and 23 February.



Technology Transfer: International Seminar*

The main recommendations and suggestions of the International Seminar on Technology Transfer [CSIR News, 23 (1973), 1] are given in the following paragraphs.

Theme I—Technology Transfer from Advanced to Developing Countries

1. Acquisition of technology and mechanism of technology transfer

Import of technology by the developing countries is necessary to bridge the technological gap and accelerate socio-economic development. The buyers of technology from the developing countries are at a disadvantage in their bargaining position because of the lack of technological infrastructure, of knowledge of different sources of available technologies and of lack of experience in the negotiations strategy.

Technology transfer cannot be treated purely as a commercial transaction between two parties or firms. Institutional mechanisms at governmental level to supplement the market process are necessary.

Every developing country should set up a 'National Technology Corporation' which should function as the main agency for evaluation and selection of appropriate technology for import.

2. Cost of technology

The cost of acquiring technology by way of foreign exchange expenditure represents a heavy strain on the economies of the developing countries. Measures are urgently called for

in order to reduce the cost of purchase of technology by the developing countries. The developing countries should strive to have a common policy on science and technology as where possible with the assistance of international organizations and U.N. agencies.

UNIDO may explore the possibilities of purchase of technology required by more than one developing country and selling it at subsidized rates to them consistent with their level of development.

3. Turnkey jobs and package deals in technology transfer

Technology transfer to the developing countries largely takes place through turnkey jobs and package deals. Transfer process should give much more information by way of how the technology is arrived at. This would mean transfer of 'know-why' along with 'know-how'.

The technological package which is being transferred should be conceived as a system involving the process/product know-how, design engineering, marketing, management and customer services. These elements should be considered from the point of view of local environment which differs from country to country.

4. Appropriate technology and selectivity in technology transfer

Developing countries should develop the technological capability to select appropriate technologies and adapt and assimilate these for further development in accordance with their national needs.

5. Policy on technology transfer and self-reliance

Each developing nation should formulate a comprehensive plan and policy on science and technology as an integral part of the national plans and programmes. Each nation should formulate its own socio-economic and technological plans for national development and priorities which should delineate areas, where technology is to be developed locally and where import of technology is necessary for accelerated development.

6. Technological and management capability as a factor in successful technology transfer

For effective absorption of technology the developing countries should establish adequate research and development base in the industries themselves. In the developing countries it may also be necessary to create adequate scientific and technological infrastructure through universities, state-sponsored industrial research and technological institutes and the like.

7. Institutional structure for technology transfer

Appropriate institutional structure should be established in developing countries to monitor, regulate and give direction to technology transfer.

8. Central agency for technology transfer

Each developing country would have to choose between the options of importing technology or generating it through its own efforts. It should set up an expert body to forecast technological development sector-wise, level of technology to be

imported or self-generated, and priorities for indigenous research and development.

International agencies such as UNIDO and UNCTAD should assist in making depth studies and surveys, inter-country comparison, sector-wise and industry-wise to help the central agencies in developing countries in making the most favourable choice.

9. *Design engineering and consultancy services*

There is need to strengthen project engineering and design capability in the developing countries. This would lead to absorption and further diffusion of the imported technology within the country itself.

10. *Personnel policies and training programmes*

It is emphasized that technology is most effectively transferred by training scientists/engineers from the recipient country on the shop floors of the industrial units in the countries which are sellers of technology.

UNIDO and other U.N. agencies should organize specialized industrial training programmes which should consist of acquisition of skills, and practical training of sophisticated equipment.

11. *Restrictive practices in technology transfer*

International action through U.N. and other agencies is necessary to curb the activities of multinational corporations and international companies in enforcing restrictive practices in the developing countries.

12. *Patent system*

Where patents are purchased as a part of technology transfer by a developing country, they should include the rights to sub-licence these to other local industrial firms/developing countries for generating additional production.

13. *Trade names and trade marks*

Foreign brand names and trade marks should not be permitted to be used in the manufactured products in developing countries.

14. *Economic and political aspects of technology transfer*

Technology transfer from developed to developing countries is not merely a commercial transaction but has economic and political aspects also. It should not be left to purely commercial processes but should be integrated with the processes of socio-economic policies and plans of the governments.

15. *Technology transfer as a global concept*

The world community as a whole should consider industrial development and economic growth as a total system involving both developed and developing countries involving deployment of skills and labour force as world resources for overall global development.

16. *Role of international agencies in technology transfer*

International agencies such as UNIDO, UNCTAD and UNDP should assist in making depth studies of inter-country operation of technology transfer sector-wise and industry-wise.

Theme II—Transfer of Technology between Developing Countries

1. *Information and data regarding technology transfer*

UNIDO should set up machinery to collect quantitative data in regard to technological transfer between developing countries. UNIDO may also publish information in the form of bulletins on such technology transfers.

2. *Information regarding available technologies*

To generate and accelerate an interflow of technology between developing countries, each country must publish an inventory of "Infor-

mation on Technology" available, including information on specialized financing and investment agencies, banks, technology sale corporations, research development organizations and engineering consulting firms.

UNIDO should take the responsibility of bringing together these inventories, technology-wise and country-wise, to facilitate technology transfer between developing countries in preference to technology transfer between developed and developing countries.

3. *Special areas for technology transfer*

Developing countries are mostly in the tropical region. They have several agricultural commodities, marine resources and mineral wealth in common. These are mostly supplied as raw materials to the developed countries. Technological experience in the field of common interest could be exchanged.

4. *Semi-modern technology*

In the context of the situations obtaining in the developing countries, it may be necessary to make use of semi-modern technology in preference to sophisticated technology in certain circumstances.

5. *Self-reliance and technology transfer between developing countries*

The natural aspirations of each developing country for maximum self-reliance has to be borne in mind. Availability of technology within the developing countries should help to lessen dependence on advanced countries and attain self-reliance.

This would mean maximum utilization of indigenous resources including import substitution and development of technologies suited to the needs and factor endowments of the countries.

6. *Sale and marketing of technology*

Developing countries should set up suitable agencies specifically designed to promote sale of technology, establishing direct links bet-

ween the developing countries to accelerate technology transfer.

7. *Identification of technological needs, cooperation and inter-regional arrangements*

Developing countries should set up organizations to identify their specific technological needs as also areas in which they can develop technology suited to their needs. It may be possible for a number of developing countries to join together and decide what they should import from developed countries. Attempts at inter-regional planning through U.N. agencies could be fruitful.

8. *Training of personnel*

Most of the developing countries do not have sufficient institutional capacity for training personnel in different specializations. Maximum use must be made of the available facilities and expertise in developing countries. This can be done by education and training of students in other countries, exchange of personnel and visits of delegations and exhibitions.

For upgrading skills in developing countries, regional training centres may be necessary.

9. *Assurances and guarantees in technology transfer*

To overcome the distrust in the reliability of technology among developing countries, guarantees of performance could be given through clear demonstration of the actual industrial use of technology. Suppliers of technology must underwrite the investment and provide for penalties for failures.

Since the developing countries will not be able to afford loans and credits to other developing countries as a part of technology transfer process, international organizations such as the World Bank should place greater emphasis and provide financial support for technologies available from developing countries.

10. *Selection of areas for specialized technology development and its diffusion between developing countries*

Developing countries should coordinate their own plans to focus attention and efforts in specific areas of research and development and technology effort including engineering consultancy services so as to generate export potential for other developing countries or even to the developed countries.

Transfer of technology may take into account the socio-economic pattern of the recipient country. It need not be a purely commercial transaction. Such transactions could be looked upon as cooperative system of industrial and technological growth where expertise may be assured from the developing countries.

Some developing countries have the capability and the infrastructure to absorb imported technology from the developed countries and adapt it for their specific prevailing conditions. Such countries should be encouraged to make available such technologies to other countries. Schemes may be formulated for preferential treatment for transfer of technology between developing countries so that this may provide socio-economic benefits to the region on a bilateral arrangement basis.

11. *Removal of restrictive practices*

International action could be taken to remove restrictive utilization clauses so that technology patented in or otherwise imported by the developing countries could be passed on by them to the other developing countries. When necessary, technologies in essential areas such as population control, essential drugs and medicines, agro-chemicals and fertilizers, low cost housing and pollution control could be acquired by UNIDO and supplied at nominal charge to the developing countries.

12. *Publicity, communication links, seminars and conferences*

UNIDO might identify areas where technology transfer is necessary between different developing countries, publish success stories and failure cases and provide a forum for exchange of views and experience of scientists and technologists.

Each developing country should publish success stories and ensure maximum diffusion at national and international levels. Case studies should be made where foreign technology has been improved upon by the developing countries.

Theme III—Technology Transfer from Laboratory to Industry

1. *R & D infrastructure in developing countries*

It was recognized that some of the developing countries do not as yet have a well-organized scientific and industrial research infrastructure. In order to make a start for the future, steps must be taken to initiate industrial research and development in academic institutions and universities. When the availability of technologically trained personnel is limited, industrial companies should develop close liaison with research students and staff in the universities. Their research work should be oriented towards industrial needs through frequent interaction with the operations of industry.

2. *Personnel for industrial R & D*

Training of research and development personnel with the right orientation for conduct of industrial research is essential. The research scientist should have not only a feel of the scientific aspects but also of the practicability and economic dimension of the results of research. There should also be a mobility between the research staff in the R & D organizations and the industrial firms as also the universities.

3. *Planning for science and technology*

In the developing countries integration of the economic policies of the governments with those for development of science and technology could lead to an accelerated transfer of technology from the R & D organizations to the stage of industrial production. There has also to be an inter-relationship between the policies for the import of technology and those of its indigenous development including absorption of acquired technologies and development of newer ones.

4. *Identifying the problem and the user*

It was noted that in most developing countries, first efforts in R & D would have to be in state-sponsored organizations or the universities. Systematic and close contact between R & D organizations, industrial users and the government is essential to determine the problems of relevance to industry and priorities for research and development and to ensure that the developed technology is exploited and used by the industry.

5. *Research management*

Resources invested in the establishment of R & D infrastructure and facilities need a high degree of capability and expertise for producing optimum results. Attention should be paid even at an early stage in the developing countries to the training of personnel for management of industrial research institutions.

6. *Importance of development, pilot and demonstration units*

In most of the developing countries, marketing of results of indigenous research is possible only if it is carried to the development stage to ensure for a degree of safety margin to the user. Adequate resources should be made available to R & D organization to put up pilot

plant research and demonstration/prototype units.

7. *Role of engineering consultants*

In order to ensure competent transfer, association of engineering consultants to design and engineer the plants based upon the know-how and technology developed by the research organizations is essential. The engineering consultants could then provide performance and other guarantees to the user.

8. *Incentives for utilization of indigenous technology*

Industrial firms in the developing countries should be provided sufficient incentives if they have to be persuaded to utilize the results of indigenous research in preference to import of technology.

9. *Transfer of technology through personnel mobility*

There should be sufficient flexibility to permit a scientist/engineer to move out to the industrial firm for a limited period or permanently till the process researched by him has been successfully translated into industrial production.

10. *Role of a research development corporation*

For effective transfer of results of laboratory research to industrial production, it is of advantage to have an agency like the Research and Development Corporation which would have the responsibility to locate the right parties, negotiate terms, license the know-how, arrange pilot plant demonstrations, contact engineering consultants and give risk guarantees.

11. *Single-point transfer of technology*

Under the conditions obtaining in the developing countries it is essential that the Research and Development Corporation or any other licensing agency is able to offer a package to the prospective entrepreneur.

12. *Transfer of technology to rural community*

The research and development and technology developed for rural areas should take into account the comparative backwardness of the rural community. The need for an on-the-spot demonstration, exhibition of a working unit and assistance in installation, erection and commissioning to create confidence in the rural areas is felt to a greater extent than in the case of urban areas.

13. *Importance of language in technology transfer*

To ensure technology transfer within the rural and backward areas, special efforts should be made to produce technical literature in a language easily understood by the people.

Hydrogen Codeposition during Electro-deposition of Metals with Particular Reference to Chromium

The study has been carried out by Shri N.V. Parthasaradhy of the Central Electrochemical Research Institute, Karaikudi, under the direction of Dr H.V.K. Udupa of the institute.

The hydrogen embrittlement characteristics of steel during electro-deposition of metals, with particular reference to chromium, have been evaluated by the electropore technique. A suitable electrochemical cell was designed for this purpose. This is the first report of the application of the technique with special reference to electrodeposition of chromium.

A few experiments were carried out on the electropore characteristics of a few typical nickel bath formulations and cyanide copper electrolytes.

The studies included three types of chromium electrolytes, viz. standard, high-sulphate and sulphate-cryolite, over a polarizing current den-

sity (c.d.) range of 165-1080mA cm⁻² and temperature range of 30-50°C. The maximum hydrogen coverage observed was typical of each electrolyte and did not vary systematically either with c.d. or temperature, as in the case of an acid or alkali. The existence of a limiting c.d. has been proved to be the cause of such a behaviour.

To understand the behaviour of chrome deposits, the permeation rates of 10 μ thick deposits were compared. The permeation rates of widely differing deposits—crack-free to highly cracked and mirror bright to dull—were explained in terms of (i) crack nature, (ii) physical appearance, and (iii) degree of packing (coarse/fine grained). Further, the difference in the ability of fine and big cracks to 'block' or 'favour' hydrogen entry respectively was interpreted in terms of concepts on 'mechanism of chromium deposition put forward by Gerischer and Kappel and 'microthrowing power'.

A majority of the chromium deposits possesses adequate porosity, which means that they can be de-embrittled with ease by baking the plated specimen, as observed in practice. Further, hydrogen intake by steel during chromium plating is considerable and the process is more embrittling than cyanide cadmium plating, as observed by others on the basis of mechanical tests.

The diffusion coefficient, D , for hydrogen in steel during electrodeposition of chromium was evaluated by three methods. The D values obtained are: 3.55 ± 0.32 ; 4.88 ± 0.37 , and 5.72 ± 0.32 at 30°, 40° and 50°C respectively. The activation energy for diffusion works out to 5.09 kcal/mol hydrogen. These values are in agreement with reported values. An attempt was also made to use the quantity of hydrogen stored by the system under steady state condi-

tions (assessed from the decay curve) to estimate the amount of hydrogen retained by the chromium deposit. The hydrogen intake was found to vary from 2 to 54 cm³ per 100 g of the chromium deposit.

Permeation measurements in special chrome bath formulations like high-temperature high-ratio bath and tetrachromate solution indicate that the former is more embrittling than, and the latter is similar to, the standard chrome bath. In pure chromic acid, polarization of steel introduces large quantities of hydrogen into the cathode, compared to the chrome baths. This is in conformity with the findings reported in literature.

The limited number of experiments conducted in four types of nickel electrolytes lead to the conclusion that they confer insignificant embrittlement, in agreement with literature reports. Use of nickel undercoat prior to chromium deposition shows that (i) thin deposits up to 20 μ thickness enhance the permeation rate, and (ii) deposits in the range 35-60 μ lower the hydrogen entry, compared to the chromium plating without an undercoat.

Electrodeposition of copper from cyanide electrolytes was seen to be similar to chromium deposition from hydrogen permeation viewpoint. Even thin deposits of copper as an undercoat were observed to block completely the hydrogen entry during subsequent chromium deposition.

The D values calculated from the electropemeation data in nickel and copper electrolytes agree well with the values obtained in chromium electrolytes.

The researcher Shri Parthasaradhy was awarded Ph.D. degree in chemistry by the Banaras Hindu University, Varanasi, for his thesis based on the above studies.

Studies in a Slurry Reactor : Hydrogenation of Glucose on Raney Nickel

The catalytic hydrogenation of glucose to sorbitol is a problem of two-fold interest; it is an excellent example of slurry reactor, and the reaction itself is of great industrial significance since sorbitol finds a variety of uses.

In a slurry reactor, three regimes of control are possible—mass transfer from gas to liquid, mass transfer from liquid to catalyst particles, and chemical reaction on the catalyst surface. But to date no complete studies have been reported wherein the entire spectrum of the controlling regimes has been investigated of such a system of industrial value.

Innumerable patents and papers are available on the catalytic hydrogenation of glucose to sorbitol. However, literature contains scanty information relating to the kinetics of the reaction. There has been no attempt made so far to explain the reaction (in the kinetic regime) on the basis of a heterogeneous model.

In view of the facts mentioned above the present investigation was undertaken by Shri P. H. Brahme of the National Chemical Laboratory (NCL), Poona under the supervision of Dr L. K. Doraiswamy of the laboratory. The following were the objectives of the study: (1) to make a detailed analysis of the controlling regimes in the hydrogenation of glucose on Raney nickel in a slurry reactor; (2) to obtain the necessary data on the solubility of hydrogen in glucose solution for testing probable models for the heterogeneous reaction; and (3) to undertake a detailed analysis of the various Langmuir-Hinshelwood models and to discriminate between them with the object of arriving at the most suitable model for the reaction.

An agitated 2-litre stainless steel autoclave was used in the investigation. The solubility data were determined in a specially designed apparatus and the results were correlated by an empirical equation.

By studying the effect of stirrer speed and temperature on the reaction rate, and also by estimating the liquid-solid mass transfer coefficient from known correlations, the conditions under which kinetic control prevails were established. It was found that at stirrer speeds higher than 500 rpm and at temperatures below 100°C kinetic control prevails.

Under conditions of kinetic control, detailed heterogeneous modelling of the reaction was attempted. Based on 18 possible (Hougen-Watson) models, five were selected for discrimination. Parameter estimates of these five models were obtained from nonlinear least squares analysis using a digital computer. Discrimination between the five rival models was then accomplished by using seve-

ral methods, viz. (i) by intrinsic parameters; (ii) by comparing the Henry's law constant as determined from solubility data with the value obtained from parameter estimates of the rival models; and (iii) from the dependence of one of the intrinsic parameters on the initial glucose concentration. The last two methods are typical to the system of this type (slurry reactors) and have not been used before.

All these tests have shown conclusively that the reaction between glucose and hydrogen is controlled by the desorption of sorbitol with reaction between molecularly absorbed hydrogen and glucose in the liquid phase. Arrhenius equations for rate and adsorption constants of this selected model were established as also the dependence of the rate constant on catalyst concentration.

The researcher Shri Brahme was awarded the Ph.D. (Tech.) degree by the Bombay University for his thesis relating to the studies.

from the naturally occurring iron oxide, known as blue dust, were completed. The reduction was carried out using hydrogen and refinery gas. With hydrogen, the reduction to metallic iron was complete even at low temperatures. The iron powder obtained was found to be pyrophoric in nature. It is found that in order to make the metal powder non-pyrophoric it needs to be cooled in an inert (nitrogen) atmosphere.

The effect of ultrasonics on the extraction of alkaloids strychnine and brucine from nux vomica seeds has been investigated. Slurries of nux vomica seed powder in ether and chloroform were subjected to 1 Mc/s frequency and 2 W/cm² intensity ultrasonic energy. It was found that at ambient temperatures, good yields were obtained in a few minutes which would take several hours through conventional chemical extraction procedures. The alkaloids were characterized through melting point and infrared, ultraviolet and rotation properties.

Laboratory experiments were carried out to study the extraction of lemongrass oil by steam distillation. Based on the results, a 100 kg steam distillation unit has been fabricated; this can be used conveniently in fields for the isolation of essential oil from lemongrass.

A process for the preparation of oxalic acid using the oxidation method has been developed utilizing cellulosic raw materials, mostly mohua flowers. The oxalic acid thus obtained has a purity of 97-99% and mp 99.5-101.5°C. The yield of the acid varies between 25 and 60% depending upon raw materials; the yield was found to be 40-50% when mohua flowers were used.

Investigations at the laboratory have shown that fish protein concentrate (FPC) having about 85% protein could be obtained from whole fish using isopropanol as a

PROGRESS REPORTS

RRL, Bhubaneswar Report : 1967-72

Various research programmes oriented towards defence, agriculture, food production, import substitution and export promotion have been described briefly in the progress report of the Regional Research Laboratory (RRL), Bhubaneswar for 1967-72 under the following heads: (i) processes/equipment developed; (ii) processes/equipment under development; (iii) new analytical methods developed; and (iv) long-term national projects.

Studies on the beneficiation of Indian graphites have been conducted and a process has been developed involving a new type of flotation column in place of conventional

cells. Experiments were conducted in a 2-in-diam. glass column, and high-purity graphite containing up to 96% carbon could be obtained continuously from ores containing 20-30% carbon. An experimental unit rated at 1 tonne per 24 hr of high-purity graphite has been designed, fabricated and has undergone successful trials.

In order to convert sodium chromate into sodium bichromate, a process has been developed which uses hydrochloric acid in place of sulphuric acid to obviate the difficulties involved in importing sulphur, particularly in view of its world-wide shortage. Feasibility studies and fixation of conditions for laboratory scale production of iron powder

solvent with yields of FPC up to 15%. The maximum fluoride content of the product was far below the maximum safe limit of 100 ppm.

A simple fluid energy mill has been developed which finds wide applications in chemical, pharmaceutical, food and mineral industries in order to carry out mixing, drying, coating, reacting and grinding of materials to sub-sieve ranges. The mill has provision for internal classification and optional bypass system in order to feed back oversize particles.

A completely indigenous ultrasonic therapy unit has been designed which provides a modulated rf with an output of 15 W and peak output of 60 W. This ensures the peak power intensity of less than 3 W/cm² to avoid any possible damage to the tissues. Circuits for power ultrasonic generators for different powers and frequencies have been developed. Based on the studies the following circuits are recommended: below 100 W—transistorized circuits; between 100 and 1000 W—single valve oscillators; and above 1000 W—circuits with driving oscillator coupled to an amplifier.

The following are some of the main processes/equipment under development at the laboratory: (1) catalysts based on iron, vanadium, nickel, etc.; (2) quality paper cones for loud-speakers; (3) X-ray and instrumental analytical methods; (4) edible quality sal seed oil and sal seed flour; (5) self-descaling distillation tower; (6) continuous mixer-cum-pelletizer; and (7) oil diffusion pumps, an ultrasonic welding unit, ultrasonic drill, mechanical ultrasonic generators, and turbomixers.

Analysis of a mixture containing metallic iron, ferrous and ferric oxides, photometric determination of manganese, and determination of percentage metallization are some

of the important new analytical methods developed at the laboratory.

A brief description of the work being carried out in regard to the long-term national projects has been given covering design and development of a continuous food freeze drying plant; extraction of nickel from ultrabasic rocks; pelletization of 'blue dust' and iron ore fines; and pipe line transportation.

Progress in Geophysics: 1969

Brought out by the Geophysics Research Board (GRB) of CSIR and the National Geophysical Research Institute (NGRI), Hyderabad, *Progress in Geophysics*, an annual publication, reviews the progress of geophysical research in India every year. This volume is the fifth in the series and covers the period January to December 1969.

The publication contains reviews of work in the following 10 areas of geophysics compiled by specialists: Gravity and geodesy (J. Chatterjee);

Seismology and physics of the earth's interior (H.M. Chaudhury); Volcanology, geochemistry, geochronology and tectonophysics (M.S. Bala-sundaram); Geomagnetism and geoelectricity (B.N. Bhargava); Aeronomy and space science (K.R. Ramanathan); Meteorology and atmospheric physics (P. Koteswaran); Hydrology (C.L. Ranganathan); Physical oceanography and marine geophysics (N.K. Panikkar); Geophysical exploration for ground water, mining geology and engineering geology (L.N. Kailasam); and Geophysical exploration for oil (S.N. Sengupta).

A bibliography is provided under each review. The publication also contains a brief annual report of the Geophysics Research Board for 1969-70.

The 142-page (royal 8vo) publication is priced Rs 7.50 (\$ 1.50), and is available with the Geophysics Research Board, National Geophysical Research Institute, Hyderabad-500007.

PROCESSES & PRODUCTS READY FOR COMMERCIAL UTILIZATION

Running Motor Winding Temperature Indicator

The temperature rise of the winding of an induction motor may be taken as a primary indication of the condition of the motor in its working state, particularly when the motor works in a sealed container or at a place which is not accessible for inspection. A German firm manufactures such a unit which is suitable for the measurement of winding temperature of small motors. In this indicator the increase in resistance due to rise in temperature is measured by a dc bridge in which the winding constitutes one arm of the bridge. The difficulty in using dc excitation for the bridge in the presence of a large amount of ac has been partially surmounted by the firm by using a heavy choke in

series with the dc source; an inductance capacitance series resonance circuit is used to prevent the flow of dc in ac line. The application of this principle is feasible only in the case of small motors where ac current is not very high. The limitation has been overcome by adopting a different principle in the unit, which has been developed by the Central Mechanical Engineering Research Institute (CMERI), Durgapur. In this unit, part of the line current is rectified to produce a small dc component in line current and this dc component has been well utilized for exciting the Wheatstone bridge of which the winding of the motor constitutes one arm. Thus the range of the instrument is extended up to 5 hp, which can be indicated directly during the actual operation of the

motors. Such an instrument displaying the rise in temperature of larger motors, particularly in the sealed unit of a refrigerator, was not available so far. This unit is therefore expected to find application for such measurements not only in refrigeration engineering but also in general electric motor manufacturing industry.

The range of nominal resistance of the winding in the instrument developed by CMERI is 5-25 ohms.

Two prototype units suitable for rating up to 0.5 hp and 5 hp motors have been fabricated and are under regular use in the laboratory.

If the production of this unit is started there may be considerable demand from manufacturers and educational institutions.

For fabricating the unit, a general type of workshop is needed and no special type of equipment is required. All components required for the fabrication of the indicator, such as motors, resistances, capacitances and rectifiers, are indigenously available.

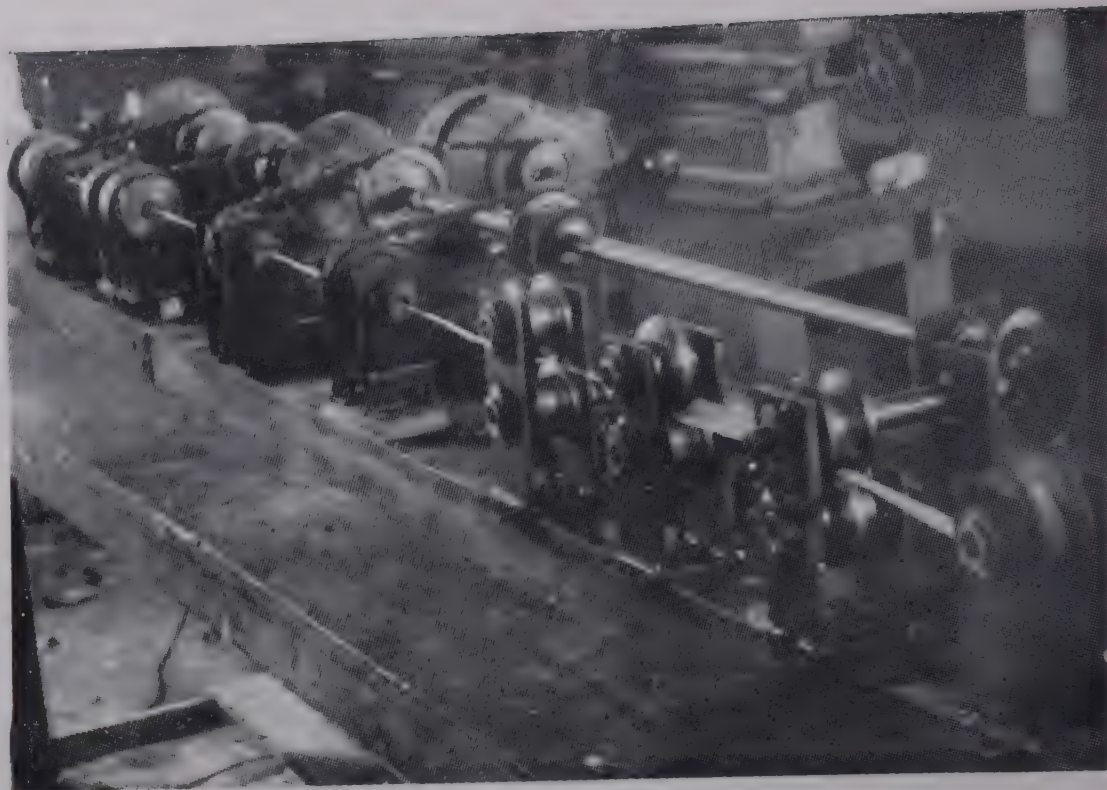
The cost of the prototype unit varies from Rs 1000 to 2000 depending upon its horse power (0.5-5.0 hp).

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Paper Twine Producing Machine

Paper twine finds wide application for packing purposes and for making belts. The use of paper twine is well established in other countries but in India it is slowly getting popular. At present paper twine and the machine required for making paper twine are imported.

The Regional Research Laboratory (RRL), Jorhat, has designed and developed a machine for producing paper twine. The machine consists main-



Paper twine producing machine developed by RRL, Jorhat

ly of a paper tape feeding device, die blocks and withdrawal strand. The necessary drives for the strands are provided from one main drive consisting of a 3-phase motor (ac) and a gear box through a line shaft. The withdrawal strand is designed for uniform pulling of thread. The rate of production of twine is estimated at 30 m per min.

The overall dimensions of single strand machine are: length, 150 cm; breadth, 80 cm; and height, 35 cm.

The machine can be used for obtaining threads of different diameter by changing the dies. Between the gear and the motor, a variator pulley is provided for the regulation of speed. The machine can be single strand one, with provision for making a single strand of twine at a time or a multistrand one with provision for making a number of twines at a time. The necessary drives for all the strands are provided from a single main drive consisting of a motor, a gear box and line shafts.

All the raw materials like special steel used for open gears and other wear-resistant parts, gun metal for bushes, and mild steel for other

parts, motor, variator pulleys and gear box can be procured from indigenous manufacturers. Lathes, universal milling machine, shaping machine, drilling machine, power hacksaw, welding set, grinder and other miscellaneous tools can be fabricated indigenously.

The investment for a plant capable of producing 50 pieces per year is estimated at Rs 6.42 lakh (Rs 5.46 lakh on plant, machinery and buildings, etc. and Rs 96 000 as working capital). The cost of production per piece comes to Rs 7900.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Paper Twine

Following the development of the design of a paper twine making machine the Regional Research Laboratory, Jorhat, has evolved two formulations for surface treatment of paper in order to make it suitable for twine making.

The process for the production of paper twine consists of surface treatment of the paper with a surface sizing composition with or without

dye, drying and subsequently making the twine from the surface-treated paper strip in a machine.

Paper (bleached or unbleached) and chemicals are the raw materials required in the process.

Equipment required are heater, vessel, impregnation unit, twine making machine and cutter.

Paper twine can be produced on a small scale industry basis. A machine with a capacity of 27.5 m per min yields 31.5 kg of product (25 600 m) when produced from a paper strip of 1.5 cm width.

The capital investment for setting up a production unit with the above capacity per day would be Rs 73 500. The production cost works out at Rs 1.20-1.47 per metre of paper twine.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Monochloroacetic Acid

Monochloroacetic acid is an important intermediate for the synthesis of dyes (indigo, etc.), and pharmaceuticals such as pyridoxine (vitamin B₆) and other vitamins, theophylline, aminophylline, glycine and phenylglycine. It is also used in the manufacture of thiocyanate insecticides. It is also the starting material for 2, 4-dichlorophenoxyacetic acid (2, 4-D) and 2, 4, 5-T, which have a very good market in India. The bulk use of monochloroacetic acid is in the manufacture of carboxymethyl cellulose.

Monochloroacetic acid is known to be produced in the country by about five firms. Their total annual capacity is about 2550 tonnes.

The present method of manufacturing monochloroacetic acid in India is mainly based on semi-batch method which has several disadvantages. The product is only 92-93% pure and is not suitable for the

manufacture of 2, 4-D and other weedicides. The cost of purification is high both by way of operational costs and capital investment.

The Regional Research Laboratory (RRL), Hyderabad, has developed a process for the manufacture of monochloroacetic acid. The process consists in the chlorination of acetic acid with a certain proportion of catalyst in a continuous reactor with recycling facility. A uniformly high purity (98%) product is obtained. The initial investment for the production of the compound based on the laboratory's process is low compared to the semi-batch process.

The process has been studied on 25 kg per day and 150 kg per day scales.

Acetic acid, catalyst and chlorine

CSIR SUPPORT Completed Schemes

Nature and Role of Supports in Supported Dehydrogenation and Dehydration Catalysts

The catalytic activity of ZnO for the decomposition of isopropanol depends on its mode of preparation. While the sample obtained from the nitrate is inactive the commercial sample of ZnO and that obtained from the hydroxide and oxalate are quite active. The ZnO obtained from the nitrate is yellow in colour and its X-ray diffraction lines follow a sequence of intensity different from that given in the literature. This is probably the consequence of a change in the atomic positions in the lattice which leads to a suppression of its dehydrogenation activity. The ZnO obtained commercially and from the hydroxide are white in colour and exhibit a normal sequence of intensity similar to that reported in the literature.

The effect of MgO, Al₂O₃, and TiO₂ on the activity of ZnO has been studied by Miss R. Uma, a CSIR research fellow, at the Indian

are the main raw materials needed. All are available in the country.

The essential items of plant and machinery are: storage tanks, mixing tank, feed tank, chlorine cylinders, reactor with accessories, HCl absorption column, gas preheater, distillation columns, baking unit, pumps, water-sealed vacuum pump, boiler, refrigeration unit and drilling plant.

The total capital investment for putting up a plant with 3 tonnes per day capacity as estimated by the laboratory is Rs 42.00 lakh. The cost of production has been worked out as Rs 4300 per tonne.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road Lajpat Nagar III, New Delhi 110024.

TO RESEARCH

Institute of Technology, Madras. These provide examples of different types of oxides enhancing the same type of activity, namely dehydrogenation of isopropanol. Mixed oxide catalysts were prepared from the nitrate as well as from the hydroxide in order to study the effect of the product on the catalytic activity.

Al₂O₃ is purely dehydrating. The ZnO—Al₂O₃ impregnated catalysts exhibit both dehydrogenation and dehydration activities for all the compositions studied. A twin peak curve is observed when the dehydrogenation activity is plotted against composition. In the co-precipitated system there is only dehydration in the case of catalysts containing small amounts of ZnO. The other compositions tried exhibit only dehydrogenation activity. The dehydrogenation activity shows a rise, followed by a fall to a steady value as the ZnO content is increased. Both the systems give rise to the same trend when surface area per gram of catalyst is plotted against composition though their absolute values are different.

This means that the same sort of interaction is taking place between the two oxides in both the systems. But since the two systems differ in regard to the products of reaction and also their activity patterns, probably the extent of interaction between the two oxides giving rise to the dehydrogenation activity is different. X-ray analysis shows the presence of ZnAl_2O_4 in them. The interface between ZnAl_2O_4 and ZnO is found to be the seat of activity for the dehydrogenation reaction in the Al_2O_3 -rich regions of the mixed oxide while the interface between the pure components is responsible for reaction in the ZnO -rich regions. The contribution of the latter to the dehydrogenation activity in the Al_2O_3 -rich regions cannot be completely ruled out. Reactions were also carried out on sintered $\text{ZnO-Al}_2\text{O}_3$ impregnated catalysts and on impregnated catalysts containing sintered Al_2O_3 . The same conclusions were arrived at regarding the nature of the active species. Pore size distributions in the catalysts were also measured. The dehydration activity is found to be dependent on the extent of micropores.

The ZnO-TiO_2 Catalysts exhibit only dehydrogenation activity though pure TiO_2 is predominantly dehydrating catalyst. The dehydrogenation activity pattern is similar to that observed in the $\text{ZnO-Al}_2\text{O}_3$ co-precipitated system. Like pure MgO , ZnO-MgO catalysts obtained from the nitrate as well as from the hydroxide are purely dehydrogenating. The ZnO-MgO impregnated catalysts show a rise, fall and then a rise in the dehydrogenation activity when plotted against composition. This is followed by another fall and a rise in activity in the case of the ZnO-MgO catalysts obtained from the hydroxide. Surface area measurements were made

for all these catalysts. X-ray analysis gives no evidence of any new compound formation. In both the ZnO-TiO_2 and ZnO-MgO systems the interface between ZnO and the added oxide is found to be the seat of dehydrogenation activity.

X-ray analysis reveals that in most of the mixed oxide catalysts ZnO follows the normal sequence of intensities for its reflected lines. In some cases there is some alteration. But the sequence does not correspond to that observed in the inactive ZnO obtained from the nitrate. So the added oxide helps in the formation and stabilization of ZnO in the normal and active form.

Kieselguhr is found to be inactive for isopropanol decomposition and was chosen as a support. X-ray analysis shows ZnO to exist in the normal form in ZnO-kieselguhr catalyst. But this catalyst does not dehydrogenate isopropanol. So the nature of the added oxide also contributes towards the enhancement of dehydrogenation activity. The mixed oxide catalysts obtained from the hydroxide are more active than those obtained by impregnation. This is probably due to a better mixing of the two component oxides in the former, leading to an increase in the extent of the active interface.

To understand the role of the added oxide in modifying the properties of a catalyst it is necessary to vary only one of the parameters at a time while maintaining other conditions constant. The influence of the ionic radius of the metal atom in the added oxide was studied using gallium oxide since Ga_2O_3 and Al_2O_3 resemble each other in many respects except their cationic radius.

Pure gallium oxide obtained from the nitrate exhibits both dehydrogenation and dehydration properties. $\text{ZnO-Ga}_2\text{O}_3$ catalysts containing small amounts of ZnO show enhanced dehydration activity with no de-

hydrogenation at all. The catalysts of other compositions show dehydrogenation activity alone. The dehydrogenation activity in these catalysts is attributed to the presence of ZnO-Zn gallate or $\text{ZnO-Ga}_2\text{O}_3$ interface, the contribution of each of them being dependent on the composition. The X-ray diffraction pattern of the Ga_2O_3 sample obtained from the nitrate did not correspond to any of the forms reported in the literature. Hence a strict comparison between $\text{ZnO-Al}_2\text{O}_3$ and $\text{ZnO-Ga}_2\text{O}_3$ could not be made.

Varying the oxidation state of the added oxide alone is not experimentally feasible since oxides having cations of different charges differ in their structures also.

According to the dehydrogenation activity, the most active catalyst in each of the impregnated series can be arranged in the order:

$10\% \text{ZnO-TiO}_2 > 66\% \text{ZnO-Al}_2\text{O}_3 \approx 59\% \text{ZnO-Ga}_2\text{O}_3 > 14\% \text{ZnO-MgO}$.

In the mixed oxide catalysts obtained from the hydroxide the order of activity is $67\% \text{ZnO-Al}_2\text{O}_3 > 57\% \text{ZnO-MgO}$. In all these catalysts the interface between the component oxides is the seat of dehydrogenation activity. Taking into consideration the oxidation state and ionic radius of the cation, such a trend in activity leads to the conclusion that the valency of the cation is more important than its ionic radius. However, it cannot be concluded that the oxidation state of the cation alone determines the catalytic activity because other parameters like the interatomic distances and type of semiconductor behaviour of the oxides need also to be taken into account.

In all the mixed oxide catalysts the dehydrogenation activity is always higher than that of pure ZnO , confirming that mixed oxide catalysts exhibit better catalytic properties. However, the enhancement in the

activity is a function of many parameters and cannot be attributed to any one single property.

Theoretical Studies in Molecular Force Fields

Molecular force field study is of importance because such a study verifies the correctness of the assignments of frequencies which are observed in the infrared and Raman spectra. There exist a number of force field, viz. central force field, valence force field, general valence force field (GVFF), Urey-Bradley force field (UBFF), orbital valence force field (OVFF), modified Urey-Bradley force field (MUBFF), and modified orbital valence force field (MOVFF) based on different assumptions. It is important to find a suitable force field for a particular type of molecule and anion. Frequency fitting and the trends in the theoretically calculated force constants, mean amplitudes of vibration, and Bastiansen-Morino shrinkages with respect to atomic and molecular data give the suitability of the force field model as well as the approximation used for the complete evaluation of the molecular data.

Every force field has its own merit. The object of the present studies carried out by Dr M.L. Mehta, a CSIR research fellow, Department of Physics, University of Jodhpur, Jodhpur, is to find a suitable force field for XY_6 type of molecules and anions possessing octahedral symmetry. The studies were made under the direction of Dr M.N. Awasthi of the Department.

Using Wilson's GF matrix method, Kim *et al.* [*J. mol. Spectrosc.*, **26**, (1968), 46] have made a systematic study of simplified force fields (OVFF and UBFF) for hexafluorides, and very recently, Labonville *et al.* [*Coord. Chem. Rev.*, **7** (1972), 257] have studied all the five important force fields for a number of hexahalide molecules and anions.

In these force field models, the number of calculated force constants is less than the linear expressions involving the force constants; therefore, the weighted least square procedure has been applied to fit the experimentally observed frequencies. For each cycle of iteration, a fresh Jacobian is calculated with an improved set of force constants. The calculations are repeated until all the force constants converge to definite values. Such a calculation has been performed for 14 anions of XY_6 type and it has been found that in the case of simplified force fields, OVFF is superior to UBFF and in the case of modified force field, MOVFF is superior to MUBFF.

Protein from Petroleum Hydrocarbon: A Trend Report 1961-70

Production of single cell protein (SCP) from petroleum hydrocarbons has, during the sixties, attracted the attention of microbiologists, biochemists, chemists, chemical engineers, nutritionists and food technologists throughout the world as this route seems to hold the key for solving the protein problem of the world. Several oil companies, universities and government R & D institutions all over the world are pursuing vigorous research and development work to produce SCP on a commercial scale. During the last decade a large storehouse of knowledge has accumulated on the subject. However, as the subject is highly interdisciplinary, the literature is widely scattered. Moreover, a large volume of literature on the subject is in semi-published form, which is not covered by abstracting and indexing services.

In this report Shri B. R. Bhuyan of the Regional Research Laboratory, Jorhat, has made an attempt to study the trend of development of the subject and to survey the literature during the decade 1961-70. The

report is in part fulfilment of the requirements of the Training Course in Documentation and Reprography (1970-71) conducted by Insdoc. In this report (pages vi+206) the subject has been dealt with in nine chapters: (i) Introduction, (ii) Single cell protein, (iii) Petroleum hydrocarbon as the source of SCP, (iv) Processes for the production of SCP, (v) Separation, purification and processing of SCP, (vi) Bioengineering aspects of SCP production, (vii) Work on SCP, (viii) Composition, nutrition, toxicity and cost economics of SCP, and (ix) Present status and future work. At the end of each chapter a full bibliography of the literature discussed in the chapter is given.

Among the developing countries, India has considerable expertise in this field. The Regional Research Laboratory, Jorhat, is operating a fermentor of 1 m³ capacity capable of producing 50 kg of SCP per day and the product is being evaluated as food and feed. The Indian Institute of Petroleum, Dehra Dun, is operating in collaboration with IFP a 50 kg per day pilot plant at Baroda and the product is being tested as food and feed.

The French Institute of Petroleum (IFP) has developed two processes based on (i) gas oil, and (ii) pure paraffin, extracted from petroleum by molecular sieve. The process basically consists of culturing *Candida* yeast on a reactor which is fed continuously with nutritive solution containing nitrogen, phosphorus, and salts, and air to supply the oxygen. These processes do not use mechanical stirrer, but use some other device that ensures high mass transfer. The PH, temperature, dilution rate, and input concentrations are controlled for continuous operation. The broth is continuously withdrawn and separated into two fractions consisting of an aqueous medium and cream.

The former fraction is recycled. Processing consists in inducing cell bursting by drying and granulation.

The RRL, Jorhat has been operating a 50 kg per day fermentor and scaling up a 1 ton per day capacity protein plant. The substrate used in this process is mainly gas oil. Gas oil and nutrient solution (consisting of nitrogen, phosphorus, potassium, trace elements and salts along with the necessary inoculum of stream) are fed to a specially designed continuous fermentor. The oil and aqueous medium are thoroughly mixed by high agitation using sterilized air which serves as the source of oxygen for the growth of the cells. The PH, temperature, product input and output are controlled. The broth is continuously withdrawn and passed on to a separator where the upper layer of yeast oil cream is separated from water (lower). The aqueous medium is recycled to the fermentor after the addition of nutrients and salts. The yeast cells are separated from the unmetabolized oil by a special technique. The final product is a tasteless and odourless powder. The unconsumed oil can be recycled after the addition of waxes, or can be used as commercial product.

Areas of Scientific Collaboration between India and France Identified

The second Indo-French Cultural Exchange Programme for 1971-73 envisages collaboration between the two countries in science and technology. As a result, a French scientific delegation led by Prof. Fernand Galais, Scientific Director, National Council of Scientific Research, France, visited India from 21 December 1972 to 4 January 1973. During their two weeks' stay in India, the

French delegation visited several scientific and technical research establishments and also some science-based industries. The French delegation had a final round of talks with the Indian delegation headed by Dr Y. Nayudamma, Director General, Scientific & Industrial Research.

The two delegations identified the areas in which India and France could start immediate collaboration in research, development and production. The two delegations agreed that there is a vast scope for fruitful scientific and technical cooperation between India and France. The two sides also identified those areas in which collaboration in research and development can be taken up as a long-range programme. The areas identified for starting collaboration between the two countries include: materials sciences, electronics, general and scientific instrumentation, optics, chemical technology, petrochemistry, fertilizers, and tyres. The possibility of cooperation in the areas of molecular biology, cancer research, aeronautics, telecommunication, solar energy, and leather technology was also considered.

The two sides have agreed that the result of talks between the French delegation and the Indian delegation should form the basis for a general scientific agreement to be signed by the Governments of France and India.

PATENTS FILED

715/72: An improved system of roof truss, M.M. Raju, B.P. Verma, S.V. Ali & B. Singh—CMRS, Dhanbad.

716/72: Improvements in or relating to impregnation and forming of plates for nickel cadmium batteries, H.V.K. Udupa, P.V.V. Rao & T.R. Vasanthi—CECRI, Karaikudi.

717/72: Process for making raised grain pattern on suede garment leather, M. Chockalingam—CLRI, Madras.

747/72: Improvements in or relating to production of composite nickel for sintered matrices used in alkaline storage batteries, H.V.K. Udupa, P.V.V. Rao & P. Rangorath—CECRI, Karaikudi.

748/72: Improvements in or relating to method of sintering nickel powder to produce thin sintered plaques for alkaline battery plates, H.V.K. Udupa, P.V.V. Rao & R. Sabapathy—CECRI, Karaikudi.

827/72: Improvements in or relating to the formulation of a resin binder for electrophotographic zinc oxide coatings, C.V. Suryanarayana, A.S. Lakshmanan, J. Kuppasami & K. Chandran—CECRI, Karaikudi.

986/72: A process for the preparation of terephthalic acid from *p*-xylene or *p*-toluic acid, B. Subrahmanyam, P.C. Rajkhowa, P.V. Krishna, K.W. Gopinath & M.S. Iyengar—RRL, Jorhat.

1062/72: Improvements in or relating to electrolyte bath composition of etching of aluminium and its alloys, B.A. Sheno, V. Lakshminarasimhan & D. Kanagaraj—CECRI, Karaikudi.

1090/72: Improvements in or relating to the electrolytic preparation of ferricyanides from ferrocyanides, H.V.K. Udupa, N.C. Narasimham & R. Palanisamy—CECRI, Karaikudi.

Dr K.N. Sinha

Dr K.N. Sinha, Director, Central Mining Research Station, Dhanbad, relinquished charge of his office on 5 January 1973.

Dr M.K. Chakraborty, Scientist took over as Scientists-in-charge, CMRS, Dhanbad with effect from 6 January 1973.



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International Seminar on Technology Transfer

A three-day seminar on Transfer of Technology was held at Vigyan Bhavan from 11 to 13 December 1972. Organized by the Council of Scientific & Industrial Research and the United Nations International Development Organization, the seminar was attended by participants and observers from 40 countries, representing 10 international organizations. The seminar was inaugurated by Shri V. V. Giri, President of India. Pointing out the need for eliminating the import of inessential, repetitive or unduly expensive technologies, the President stressed the fact that an indiscriminate flow should be replaced by a planned and selective transfer according to a strict

scale of priorities and with due regard to the social and economic environment of the developing countries. The flow of technology from industrially advanced countries to the less developed countries must be restricted to the needs of strategic areas and to the efficient use of agriculture-based resources. Referring to the cooperation among the developing countries in the field of transfer of technology, Shri Giri said that since the conditions obtaining in most of the developing countries in a region were more or less similar, these countries should explore the common grounds for cooperation and draw up programmes.

If the transfer of technology is to be for social good, the President went on, it should ensure that it is the most appropriate one and is modified to suit the social and economic environment. Shri Giri said that the terms of technology transfer often imposed undue strain on balance of payment, restricted export of products based on imported know-how and led to heavy expatriation of profits. To avoid such restraints and help developing countries maintain political and economic independence, the President called for new methods of technical cooperation such as exchange of information, education and movement of skilled personnel. Shri Giri also called for regional cooperation of developing countries based on 'complementary and give-and-take policy' to usher in technical progress and universal well-being.



Shri V.V. Giri, President of India, inaugurating the International Seminar on Technology Transfer

In his address, Shri C. Subramaniam, Union Minister of Industrial Development, and Science & Technology, and Vice-President, CSIR, said that India has considerable experience in borrowing technology in its industrialization programme during the past 25 years. Indian firms had entered into roughly 4000 collaborative agreements with foreign firms and agencies with or without financial participation. A critical review of what had been achieved by these collaborative agreements and the attendant losses and benefits had taught India that without a viable indigenous R & D capability of its own, a developing country is ill-equipped to know what technology existed elsewhere or to evaluate and make a selection for import, much less to absorb and adapt it after import. The bargaining power of a country in the international technological market, the Minister continued, seemed to be directly related to the extent and efficiency of its own indigenous capability in science and technology. A strong infrastructure of research and development activity is thus necessary even to be an intelligent buyer of technology from elsewhere. He said that international agencies like UNIDO could play an important role in arranging transfers of technology on mutually acceptable terms between the more developed and the less developed countries. At the national level, Shri Subramaniam said, there should be a sharp definition of the goals of each laboratory and a time-bound programme of research related to problems faced by the masses in food, clothing, housing, fuel, transport, education, health, nutrition and the like. Referring to the areas in which there could be a pooling of resources, the Minister made special mention of technology for countering pollution. He suggested a planned research and development effort in the direction

of environmental improvement with an equitable sharing of costs and transfer of technology for the common benefit of the world.

Dr I. H. Abdel Rehman, Executive Director of UNIDO, gave a special lecture on Technology Policy for Industrialization in the Developing Countries. In a reference to the well-known difficulties coming in the way of importation of technology, Dr Rehman stated that a country cannot import technology unless it has a certain capacity for selection and application of the imported technology. In many cases the imported technology cannot be applied as it is but has to be modified and adapted to a certain extent to suit the level of skill and the scale of production.

Technology cannot be created and applied to industry without a set of policies which will support its generation and utilization. These policies include incentives for innovation, financing of technological institutions, disincentive for excessive importation, encouragement of quality and excellence in design and productivity, and most important, a general policy of harmonization of consumption, production and technological capacity development through instruments of prices, taxation and credit. In this wide image of technological development for industrialization, the UNIDO chief continued, different approaches may be simultaneously required. There will be the importation of technology with best conditions and least cost possible. There will be the need for adaptation of imported technology so as to suit local materials, different production factors and market requirements. There will be technologies which would be created for situations of small scale production, low level income of consumer, or consumption within limited local markets. There

will be stringent requirement of technology for export industries at internationally competitive markets. There will be technologies for processing and upgrading of raw materials and minerals. The system of national planning affords a forward look which may go beyond a 5-year period towards a longer perspective of 15 to 20 years. From this long-range perspective, basic approaches not only of industrialization but also of technological policies should be identified. Scientific development and education generally form the basic reservoir for technology and industrialization. More attention should be given however to the problems encountered in the practice of industrial design and production which have to be solved from time to time.

In his concluding remarks, Dr Rehman made a reference to the mechanism of transfer, which in general includes technology associated with investment, with trade and technology marketed separately as patents, licences and know-how, or technology freely available in the form of information and research results. In all these aspects of technology transfer the success does not depend only on the mechanism but on the absorbing power of the recipient. Hence all measures to increase the absorbing power and interest of the would-be recipients of technology becomes in itself one important element in the technological policy.

The seminar discussed the subject of transfer of technology in three sessions each of which considered in detail the keypaper on the subject: Session I—Technology transfer from advanced to developing countries; Session II—Technology transfer between developing countries; and (iii) Session III—Technology transfer within a developing country from research laboratory to industry.

The participants discussed the subject matter of each session under four groups and all the four groups presented their group reports at plenary session for further discussion. At the closing session were adopted the report and the final recommendations

The final recommendations of the seminar will be published in the forthcoming issue.

India-Romania Agreement for Cooperation in Science and Technology

The Governments of India and Romania took an important step forward towards the implementation of the agreement on scientific and technological cooperation between them signed in October 1969. The two governments have agreed to cooperate on a number of projects during 1973-74.

The agreement on the specific projects was signed on 20 December 1972 at CSIR Headquarters, New Delhi by Shri K. G. Krishnamurthi, Secretary, CSIR, and the leader of the Romanian scientific delegation Mr. Dumitrescu Stelian, Counsellor, National Council for Science and Technology, Romania. The areas in which they would cooperate include petroleum technology, chemical technology, metallurgy, machine building, refractories, agriculture, forestry, leather industry, and health engineering. The two governments will also exchange scientific literature of use and interest to each other. There will also be exchange of scientists between the two countries in the specific fields in which they will cooperate with each other.

Hypocholesterolemic Effect of Sardine Oil and Oil-Sardine Fish

The consistently increasing death and incapacity rates caused by thro-

mbosis is evident in recent years. One significant cause can be the occurrence of a lesion in the artery wall at the site of thrombosis which seems to be primarily responsible for the coagulation and in most instances this is due to the condition termed atherosclerosis. Much of the recent work on the possible cause of atherosclerosis and coronary thrombosis in humans is concerned with arriving at a relationship between these afflictions and the raised cholesterol content of blood and serum. Association between raised serum cholesterol level and osteo-arthritis has also been reported.

The hypocholesterolemic effect of various marine oils such as seal oil, pilchard oil, cod-liver oil, manhaden oil and tuna oil in rats, chicken and human beings has been reported from abroad. The CFTRI Experiment Station, Mangalore, has now the know-how for the manufacture of sardine oil conforming to ISI specification for grade I oil intended for use in food and pharmaceutical preparations. The experiment station has also developed a process for preparing sardine oil with high iodine value which is expected to be more potent than sardine oil in regard to its hypocholesterolemic effect. The Central Food Technological Research Institute (CFTRI), Mysore, and Kasturba Medical College, Mangalore, have initiated a collaborative research programme to test oil-sardine fish, sardine oil and fractions therefrom for possible hypocholesterolemic effect. Experiments conducted with cholesterol-bile salt stressed rats indicate that both sardine oil and oil-sardine fish (*Sardinella longiceps*) are effective in lowering serum cholesterol (total, free and ester) level. The increase in heart weight and liver weight either as such or as per gram of body weight was more or less the same in all the groups including the control. Histopathological study

of different organs including heart and liver indicated no abnormality in groups fed sardine oil and sardine-fish.

In India oil-sardine fish is one of the most important commercial marine fishery constituting 20-30% of the total marine landing which is of the order of one million tonnes. At present, about 4000 tonnes of sardine oil are produced and the production is expected to reach 10 000 tonnes in the near future. In the absence of a proper outlet for the fish as fresh fish during season, about 50% of oil-sardine fish landed is either converted into fish manure or rendered into oil and meal.

The present investigation opens a new avenue for the utilization of properly extracted sardine oil. Further, the study indicates the usefulness of oil-sardine fish in diet for controlling hypercholesterolemia.

Surface Roughness Comparison Specimen

Mechanical engineering industries are now realizing the importance of controlling the surface finish of mechanical components as it plays an important role in the behaviour of components. Surface finish influences friction, wear and surface adhesion, fatigue life, tolerance and quality, and production cost.

Surface finish can be evaluated by two methods: (i) actual measurements using suitable instruments, or (ii) qualitative assessment in which the roughness of the finished product is evaluated by tactile and visual comparison with roughness comparison specimens of known value finished by similar machining process. The latter method is becoming very popular as the cost of the comparator scale is very low, and can be used (i) by engineers, draughtsmen, inspectors

and machinists to give a first-hand idea as to how the feel and appearance of the machined component are related to the surface roughness values specified; (ii) for physical comparison by visual and tactile method between the component under inspection and the standard specimen; (iii) as a basis for determining the grade of finish to be specified on the drawings.

The Central Mechanical Engineering Research Institute (CMERI),

Durgapur, has developed a process for making the surface roughness comparison specimens. The CMERI specimens are made by a special electrolytic replica process and are corrosion-resistant nickel reproductions of the master surface. The master surfaces are made to the specified surface finish values and machining process, and provide an accurate, inexpensive visual reference scale which can be used for surface finish specification and control. The process is ready for commercial utilization.

PROGRESS REPORTS

RRL, Hyderabad

Annual Report : 1971-72

The Regional Research Laboratory (RRL), Hyderabad has brought out its annual report for 1971-72. The progress in research and development activities of the laboratory is set out projectwise under the following 13 major areas of work in which the laboratory is engaged: Oils and fats; Surface coatings; Organic chemicals and pesticides; Cellulose and speciality papers; Entomology; Biochemistry; Coal; Mineral products and inorganic chemicals; Industrial ceramics; X-ray crystallography; Instrumentation; Chemical engineering; and General engineering.

With regard to the production of abrasive grade silicon carbide grain, the charge composition, design and dimensions of the furnace and furnacing procedure have been optimized. In yield and efficiency of operation as well as in the quality of the grain, the process compares favourably with international practice. The furnace has a capacity of 3 tonnes per batch. Another important achievement in the field of industrial ceramics was the design and

fabrication of a solid-solid mixer which is capable of blending several components of diverse bulk densities to give a uniform product. The mixer does not contain any moving parts, and hence contamination due to abrasion is minimized. A multideck screening machine suitable for screening abrasive grains has been designed and fabricated.

A significant achievement in the field of chemical engineering is the development of a novel method for multidimensional multistage optimization in the secondary domain. This method is computationally more sound and stable, and unlike the conventional method, does not involve the unnatural integrations. This provides an easy tool in chemical engineering optimizations, such as of a chemical reactor or a distillation column.

A preliminary survey of growth of *Aspergillus flavus* and the production of aflatoxins in cottonseed, conducted under a PL-480 programme, has revealed new information on mycotoxins in cottonseed. Procedures for optimum recovery of oil from mustard cake and seeds have been standardized.

A new method for determining the critical pigment volume concentration (CPVC) of pigments based on dielectric constant measurements has been developed. The method has proved useful in determining CPVC of anticorrosive paints. Chemical-resistant paints, enamels, primers and traffic paints were formulated using the urethane oils, prepared in the laboratory, as media and their film properties were determined. The urethane oils have shown promise as media for highly chemical-resistant and abrasion-resistant paints.

A quinone carboxylic derivative has been isolated for the first time from 1,4-naphthoquinones. β -2', 3'-Dihydrodioxypyran has been isolated from the fresh bark of *Diospyros montana*.

With the observation that the bovine spermatozoa takes up exogenously added heterologous DNA, probably into their mitochondria, a new field of study has been opened in genetic engineering. Similarly, the observation that heterologous DNA is taken up by rat liver cells, presumably by mitochondria, opens up many possibilities in cancer and genetic research. The nature and extent of heterogeneity in silk fibroin preparations have been studied.

Mycoflora and biochemical changes in the stored safflower seed were studied under different environmental conditions. The fungus *A. candidus* was found to be predominant in safflower stored at high humidities. Because of the strong lipolytic action of this mold, free fatty acids developed rapidly in the seed fat at high humidities.

Studies on the toxicity of neurotoxins released by the action of different insecticides with synergists were continued. Neurotoxins were not

synergized by piperonyl butoxide and karanjin while insecticides were. Neurotoxins act on the cardiac ganglia by paralyzing them and do not interfere with the cholinesterase system.

Mosquito repelling properties of five essential oils, viz. palmarosa, rose geranium, gingergrass, citronella and sandalwood, have been studied on human volunteers. One essential oil — rose geranium — in the form of cream has shown excellent efficacy.

Sponsored work on three research projects, viz. (i) process for manufacturing isopropyl ether, (ii) upgrading of pine tar for use in rubber industry, and (iii) preparation of aluminium hydroxide gel, has been completed successfully.

PROCESSES & PRODUCTS READY FOR COMMERCIAL UTILIZATION

Monoethylaniline

Monoethylaniline is an intermediate for the manufacture of the explosive 'Carbamite' used in military operations. At present there is no production of monoethylaniline in the country. The exact demand for the material is not available, but is met by imports. It is estimated that the demand for this product in the near future would be about 150 tonnes per annum.

A process for the production of monoethylaniline has been developed by the National Chemical Laboratory (NCL), Poona. The process consists in reacting aniline and ethanol in vapour phase in a fluidized-bed reactor at elevated temperature. The product is fractionally distilled. The laboratory investigations have been conducted on 5 kg/hr scale. Based on this work a pilot plant of 15 kg/hr capacity has been set up and successfully operated at the laboratory. The laboratory

Two industrial market surveys completed during the year relate to: (i) epichlorohydrin, and (ii) production and utilization of castor seed, oil and cake.

Know-how for the following four processes was released to industry: (1) production of cardanol from cashewnut shell liquid (CNSL) and surface coatings based on cardanol and CNSL, (2) glass-sealed terminals, (3) carbonization of pinewood, and (4) upgrading of pine tar.

One patent relating to tungsten sulphide-nickel sulphide on alumina catalyst for production of superior grade kerosene from low temperature tar and petroleum fractions was filed. Fifty-nine research papers were published.

has standardized the operating conditions and collected data on the raw material consumption and utilities, etc. The product prepared in the laboratory has been approved by the Defence Department.

Aniline, ethyl alcohol and catalyst are the main raw materials required for the manufacture of monoethylaniline. All these are available indigenously.

Reactor vaporizer heat exchangers, vacuum distillation unit, columns, storage tanks, pumps, and filter are the main items of plant and equipment. All these are either available indigenously or can be fabricated in the country.

The laboratory has assumed 150 tonnes per annum as the optimum capacity of the plant. The total capital outlay for a plant of this size has been estimated at Rs 8 lakh (Rs 3 lakh on land, building, plant and equipment, etc., and Rs 5 lakh

as working capital). The cost of production of the material according to the process developed comes to Rs 12.20/kg.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Tamarind Kernel Powder (TKP) Phosphate and Borate

Tamarind kernel powder phosphate and borate can be more effectively used for textile sizing than tamarind kernel powder (TKP) itself. The product is a good substitute for hydrolyzed maize starch. Large quantities of starch are used for textile sizing. With the development of TKP, dependence on starch is expected to reduce. As this is a new type of product, its market potentiality will have to be established.

The National Chemical Laboratory (NCL), Poona, has developed a process for the manufacture of TKP phosphate and borate. The process consists in spraying a mixture of phosphoric acid and caustic soda solution on TKP. The product is mixed well and dried at 50°C. It is powdered in a ball mill, sieved through 100 mesh and heated at 150°C. Likewise, TKP borate is prepared by spraying on TKP, a solution of boric acid, caustic soda and urea. The rest of the steps are the same as in the preparation of TKP phosphate. The laboratory work has been conducted on 5 kg scale. Tested by the Ahmedabad Textile Industry's Research Association, Ahmedabad, the modified TKP compares well with hydrolyzed maize starch.

Tamarind kernel powder, phosphoric acid, caustic soda, and boric acid are the major raw materials required for the manufacture of modified TKP. All the raw materials are available indigenously.

Sigma blade mixer, ball mill, sieving machine, and oven are the major items of plant and equipment required for the manufacture of TKP. All these are either indigenously available or can be fabricated in the country.

It is assumed that a 300 tonnes per annum unit will be the optimum size. The capital outlay for putting up a plant of this size is estimated at about Rs 2.58 lakh (Rs 1.30 lakh on building and plant, and Rs 1.28 lakh as working capital). The cost of production of the product according to the NCL process comes to Rs 1.40 per kg.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Gum Arabic Substitute

Gum arabic is used as an adhesive, in pharmaceuticals, and for textile printing, etc. It is being imported to the extent of 5000 tonnes per annum at a cost of about Rs 73 lakh. The requirement of the Posts and Telegraphs Department is estimated at 150-180 tonnes per annum. Hence the need for finding a suitable substitute for gum arabic.

The National Chemical Laboratory (NCL), Poona, has successfully developed a substitute for gum arabic starting from tapioca starch. The process developed for the production of starch-based substitute is a semi-dry process and does not involve any complicated unit operation. It consists in the spraying of the solution of disodium hydrogen phosphate and phosphoric acid on starch and drying the material at 50° C. The product is powdered in a ball mill, sieved and then uniformly heated at 150° C. The investigations have been carried out on 3 kg per batch scale in the

laboratory. The product has been approved by the Posts and Telegraphs Department for use as an adhesive.

Tapioca, starch, disodium hydrogen phosphate, and phosphoric acid are the main raw materials required for the manufacture of the adhesive. All these are available indigenously.

The main items of plant and equipment include, sigma blade mixer, ball mill, sieving machine, and oven. All these are either indigenously available or can be fabricated in the country. ?

It is assumed that 180 tonnes per annum unit would be the economic capacity. The total capital outlay for a plant of this size is estimated at Rs 2.30 lakh (Rs 90 000 on building, plant and equipment, and Rs. 1,40,000 as working capital). The cost of production according to (NCL) process comes to Rs 2.17 per kg whereas the price of imported material (adhesive grade) is as high as Rs. 6-7 per kg in Bombay.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

White Oils

White oil is a colourless transparent liquid manufactured from lubricating oil fractions of all types of crudes. White oils are generally of two grades: (i) pharmaceutical grade, and (ii) technical grade. The difference between the two grades of white oil is due to the severity of treatment and the degree of refinement given to a particular oil fraction. Pharmaceutical grades have to conform to stringent specifications so as to ensure their being free from polynuclear aromatic compounds supposed to be responsible for carcinogenic ailments. These types of oils, generally referred to as

liquid paraffin, are meant for internal use.

The basic starting material for the manufacture of white oils is petroleum oils which are easily available in the country. Lubricating oil fractions of desired properties, specially viscosity and specific gravity, are selected for this purpose. The most important refining materials used are fuming sulphuric acid (oleum) and bleaching clay, and both these materials are available indigenously.

Manufacture of white oils yields oil-soluble sulphonates of varying molecular weight which find applications in various fields, important among them being (i) manufacture of cutting oil (soluble) where the sulphonates act as emulsifiers, (ii) manufacture of motor oil detergents, and (iii) antirust additives.

The use of white mineral oils has increased all over the world with the expanding technology in the past sixty years. As key ingredients in many types of products, their applications extend from simple household oil to processing agents for the plastics industry. A plant for the manufacture of about 10,000 tonnes per annum of white oils is being put up, for the first time in the country, by Nagpal Ambadi Petrochem Refining Ltd at Madras, but in view of the growing demand for the product in the country, this quantity would not be sufficient and there is scope for another 10 000 tonnes per annum of white oils of various grades and specifications.

A considerable quantity of white oil is used up in the manufacture of petroleum jelly, imports of which are banned. Petroleum jelly is being manufactured by mixing microcrystalline wax with about 80% of white oil. The demand for petroleum jelly has been estimated at about 6000 tonnes per annum.

The Indian Institute of Petroleum, Dehra Dun, has developed complete technical know-how for the manufacture of white oils of various grades.

White oils find varied and extensive uses, as in: manufacture of petroleum jelly (for pharmaceutical and cosmetic industries), pharmaceutical ointments, nasal sprays, egg processing, food processing, hair preparations, paper impregnation, baby oils, canning industry, plastics manufacture, textile processing oil, electrical industry, leather industry, hydraulic fluids, and in military operations.

CSIR SUPPORT TO RESEARCH

Completed Schemes

Histochemical Studies on Amphibian Gonads

It is well established that the biosynthesis of all the hormonally active steroids involves the conversion of Δ^5 - 3β -hydroxysteroids to Δ^5 - 3β -ketosteroids involving Δ^5 - 3β -hydroxysteroid dehydrogenase (Δ^5 - 3β -HSDH) and an isomerase. Therefore, the presence of this enzyme system in a particular tissue suggests the steroidogenic potentiality of that tissue. In recent years histochemical methods have been evolved to detect the cellular sites of this enzyme (Δ^5 - 3β -HSDH) activity (Baillie, *et al.*, *Developments in steroid histochemistry*, Academic Press, Inc., New York, 1966).

Utilizing these methods, the steroidogenic potentiality of amphibian gonads has been studied by Shri S.K. Saidapur, a CSIR research fellow, under the guidance of Dr V. B. Nadkarni, at the Department of Zoology, Karnatak University, Dharwar (October 1970 to June 1972). The present work was also supported by the Population Council grant of the Biomedical Division, New York, awarded to Dr V.B. Nadkarni.

The economics of commercial production of the finished product at the rate of 1000 tonnes per annum has been worked out. Fixed capital cost and working capital requirements are estimated around Rs. 17.00 lakh and Rs 4.45 lakh respectively. The cost of the finished product [white oil (LV)L] is estimated at Rs 2600 per tonne.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

The studies have shown that the interstitial Leydig cells form the sole site of steroidogenic activity in the testis of three amphibian species, viz. *Rana tigrina*, *Rana cyanophlyctis* and *Bufo melanostictus*. The studies have also revealed the Δ^5 - 3β -HSDH activity in the columnar Sertoli cells of *R. cyanophlyctis*. In the case of the ovary, the follicular cells of larger oocytes (vitellogenic and mature) and the luteinized granulosa cells of the post-ovulatory corpus luteum are shown to be steroidogenic in nature. Further, the process of follicular atresia and the effect of hypophysectomy on the ovaries of *R. cyanophlyctis* have also been investigated in order to understand its significance in the ovaries of the frog. Histological and histochemical studies on the atretic follicles have revealed that they are merely large eggs in the process of degeneration and are not endocrine in nature.

Planar Transistors

The characterization of double-diffused planar transistors is an integral part of the design of integrated circuits. The physics of 'diffusion' transistor has become obsolete and is of no use from integrated circuit point of view. Hence there is a need to understand more deeply the

physics of planar transistors, known as 'drift' transistor. Theoretical and experimental investigations with regard to the characterization of planar transistors have been made by Shri T. N. Basavaraj, a CSIR research fellow, who carried out the studies at the Physics Department, Indian Institute of Technology, Delhi, under the direction of Dr A. B. Bhattacharyya of the department.

Minority carrier equivalent lifetime: One of the puzzling aspects of the device characterization is the need for using a very small lifetime for the minority carriers. This has been explained as due to electrostatic-field gradient and the mobility gradient. Apart from these two factors, the present investigations led to the conclusion that even the consideration of impurity ionization results in a low value of equivalent lifetime. Analysis has also been made for the temperature-dependence of such an equivalent lifetime in practical devices. The results obtained are extremely useful in the characterization of planar transistors, as all these three factors are predominant due to the impurity gradient in the base region.

Approximation to two-step diffusion profile: During the fabrication of integrated circuits, diffusion is done successively at different temperatures and for different times. This leads to an impurity distribution known as two-step diffusion profile which is neither erfc nor Gaussian. Even then, almost all analyses available for the design of planar transistors assume the profile to be Gaussian or an erfc, just to avoid the complexity. Surprisingly, it has been found that the two-step diffusion profile can be approximated by

$$N = Ae^{-ax/(ax+k)}$$

where N is the impurity density; A , a and k are constants; and x is the distance. This leads to a simple

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evaluation of device characteristic which is more realistic and accurate. The values of the constants and the range of the approximation were obtained for ready calculations.

Design of silicon solar cells: A theory has been developed for the calculation of the efficiency of silicon solar cells by solving the continuity equation considering the mobility variation with the impurity concentration. A salient feature of the theory is that it correlates the efficiency with the important parameter 'surface recombination velocity'. As the device is subjected to high energy irradiation, the surface gets damaged and the surface properties get deteriorated—effects which are reflected in the change or surface recombination velocity.

Effect of retarding field in base region of a double-diffused transistor: The formation of a retarding field region in the double-diffusion process of a planar transistor has been found to have an adverse effect on the characteristics, and not much work has been done in this direction. Since the planar transistors are the integral part of the integrated circuits, this problem has been studied in detail and closed-form solutions for I-V relationship have been developed. Standard curves have been presented for ready engineering design of integrated circuits.

Injection efficiency in a degenerate emitter region: Owing to heavy doping of impurities in the formation of emitter region, the silicon becomes degenerate and the electrical properties are entirely different as those of a non-degenerate silicon. The practical values of the common emitter current gain can never be obtained if one does not consider the degeneracy. A detailed study has been made and the results obtained are of considerable use in the design of integrated circuits.

It is proposed to appoint a Director to head the National Institute of Oceanography, Panaji, Goa.

Job Requirements: It is a top research management post in Oceanography. The Director is required to provide high-level leadership in the formulation of R & D programmes and projects, organizing and coordinating team work in various aspects of Oceanography. He will have the overall responsibility for the work of the institute and for creating an atmosphere conducive to creative work. He should be able to collate, correlate and sell results of research and build an image for the institute. The main objects of the institute are research and development relating to physical, chemical, geological, and biological aspects of Oceanography, etc. and international collaboration in oceanic research programmes. The Director is expected to be a guide of research, a manager and an ambassador to the institute.

Qualifications/Experience: Candidates must have high academic attainments and scientific standing in an area of science or technology related to oceanography and considerable R&D management experience. They should furnish proof of independent R&D and guiding, planning and directing research programmes in various aspects of Oceanography and ability consistent with the job requirements specified above.

Scientists/Technologists interested may obtain a standard proforma for sending their *curriculum vitae*. They can also obtain a brochure on the aims and objects, and the latest annual report of the institute.

Salary/Conditions of Service: The salary may be fixed in the scale ranging from Rs 1600 to Rs 3000 p.m. The person appointed will be on contract for a period of six years, subject to confirmation after two years of satisfactory service. Other conditions of contract will be supplied on request.

Age Limit: Below 50 years, relaxable in special cases.

All correspondence in this regard may be addressed to the Secretary, Council of Scientific & Industrial Research, Rafi Marg, New Delhi 110001, and the completed *curriculum vitae* proforma must be received in this office on or before 28 February 1973.

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It is proposed to appoint a Director to head the Central Mining Research Station, Dhanbad.

Job Requirements: It is a top research management post in the field of Mining Technology, Mine Safety, Mine Engineering and Mine Health Studies. The Director is required to provide high-level leadership in the formulation of R & D programmes and projects, organizing and coordinating team work and assuring application and utilization of the results of research. He will have the overall responsibility for the work of the institute and for creating an atmosphere conducive to creative work. The main objects of the institute are research and development in the field of coal and metalliferous mining and allied industries.

Qualifications/Experience: Candidates must provide proof of their academic level, industrial research and development experience and management abilities consistent with the job requirements mentioned above. Candidates with high academic qualifications in mining engineering or in other areas of science, technology or engineering with considerable experience of research and development and/or industrial experience in mining are preferred. Good experience of independent research and development work and proven ability to guide scientific workers in areas related to mining industry are essential. Experience of production and mining operations is desirable.

Scientists/Technologists interested may obtain a standard proforma for sending their *curriculum vitae*. They can also obtain a brochure on the aims and objects, and the latest annual report of the institute.

Salary/Conditions of Service: The salary may be fixed in a scale ranging from Rs 1600 to Rs 3000 p.m. The person appointed will be on contract for a period of six years, subject to confirmation after two years of satisfactory service. Other conditions of contract will be supplied on request.

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All correspondence in this regard may be addressed to the Secretary, CSIR, Rafi Marg New Delhi 110001, and the completed *curriculum vitae* proforma must be received in this office on or before 28 February 1973.



Seminar on Electrochemistry

The thirteenth seminar on Electrochemistry was held at the Central Electrochemical Research Institute (CECRI), Karaikudi from 22 to 25 Nov. 1972. Apart from the staff of the institute, 29 delegates from different organizations in India and from Sri Lanka, UK and USA participated in the seminar. Altogether, 53 papers including six from abroad were presented in seven technical sessions. Prof. Malcolm S. Adiseshiah, Director, Madras Institute of Development Studies, inaugurating the seminar, pleaded for research which would flow into productive innovations, using elaborate management techniques. Brief accounts of the various technical sessions follow.

Electro-organic and Inorganic Products

H.V.K. Udupa and coworkers of CECRI presented six papers dealing with the various aspects of the electrolytic preparation of glyoxalic acid, aniline, *p*-toluidine, benzyl alcohol, *p*-aminophenol and benzidine, employing the rotating electrode technique.

Batteries

P.K. Saha of Electronics Research Development Establishment, Bangalore, outlined in his paper the construction of the components of the rectangular sealed type nickel-cadmium batteries and described their performance characteristics. A paper by S. Mukhopadhyay (Indian Standards Institution, New Delhi) dealt with the testing of lead-acid storage batteries. The development of a power-pack air-depolarized battery for transistorized

community radio receiver sets was suggested as a substitute for the dry battery of the Leclanche type in a paper by H.V.K. Udupa and coworkers of CECRI, Karaikudi. The paper presented by V. K. Venkatesan of CECRI dealt with porous nickel catalysts for hydrogen diffusion electrodes for possible application in fuel cells.

Electrothermics and Electrometallurgy

Two papers by V. Aravamuthan and coworkers of CECRI were presented. One dealt with the laboratory scale studies on the production of calcium silicide through improvements effected in furnace charge and design, and claimed an yield efficiency of about 50%. The utilization of aluminium slag powder from aluminium foundry and waste emery flour from the abrasive industry was considered in the other paper and it was reported that fused alumina containing 94-97% could be produced from either of the sources.

Electrode Kinetics, Electrochemical Equilibrium and Electroanalysis

Twelve papers were presented in this session. Of these, three papers from M.A.V. Devanathan and coworkers of the Ceylon Council of Scientific & Industrial Research were on faradaic rectification at radio-frequencies, on mass transfer hydrodynamics from streaming solutions and on the potentiostatic electro-crystallization of calomel in chloride solutions. Of the other papers, mention may be made of: (i) electrolyte-solvent interactions deduced from emf measurements (C. Kalidas

et al., Indian Institute of Technology, Madras); (ii) silver-silver selenocyanate electrode (R.C. Das *et al.*, Ravenshaw College, Cuttack); and (iii) ac polarographic reduction of some aromatic nitrocompounds (H.P. Agarwal, M.A. College of Technology, Bhopal).

Corrosion

Fourteen papers including an invited paper by K. Schwabe of the Institute of Electrochemistry and Physical Chemistry of the Technical University at Dresden, GDR, were presented in this session. The inhibition of pitting of chromium-nickel steels by perchlorate ions in chloride solutions was brought out in the paper by Schwabe. Four papers by N. Subramanyan and coworkers were devoted to the inhibition of corrosion of aluminium in acidic and in alkaline solutions by various types of organic compounds by themselves and in combination with calcium. In another paper, Subramanyan discussed the electrocapillary behaviour of dimethyl sulphoxide on mercury surface in sulphuric acid with reference to its effect on the corrosion of steel in the same acid. An interesting note on the corrosive effects of non-metallic materials like plastics, rubber and wood on steel and chromium-plated steel was presented by K. Balakrishnan. It was pointed out that phenol-formaldehyde brings about maximum corrosion, but that melamine-formaldehyde does not accelerate corrosion. P.B. Mathur and coworkers reported in a paper their observation of periodic potential swings when specimens of magnesium alloys were dipped in a solution containing potassium

dichromate and perchloric acid and pointed out that such oscillations were not observed with pure magnesium or when the concentration of perchloric acid exceeded 11 g per litre. In view of the possible corrosion of steel reinforcement in cement concrete buildings, K. S. Rajagopalan and coworkers presented a paper on their analyses of cement concrete samples and pointed out that nearly one-fifth of the total chloride and one-tenth of the total sulphate remained free and hence were the cause of corrosion. The observations made in the study of atmospheric corrosion of metals at the Mangalore Harbour project were brought out in a paper presented by S. Chandrasekaran on behalf of K.S. Rajagopalan *et al.* The effects of pomegranate juice and of the extracts of pomegranate fruit shells, tamarind fruits and tea leaves were recorded in a paper by R. M. Saleh and coworkers of Egypt. S. P. Saluja described in his paper the finishing and packaging of small arms ammunition, particularly the mechanical operations and heat treatments given to alpha-brass used for making cartridge cases. S.N. Banerji of the Regional Engineering College, Durgapur, discussed the usefulness of the concept of the null points of metals with reference to corrosion inhibition.

The paper of I.P. Anoshchenko *et al.* of USSR reported the synergistic action shown by binary combinations of copper sulphate, ferric sulphate and antimony white in inhibiting corrosion of titanium in sulphuric acid.

Solid State Electrochemistry

In three papers by C.V. Suryanarayana and coworkers, the development and characteristics of a new magnesium fluogermanate red phosphor, of cadmium selenide photocells and of zinc sulphide phosphor were described.

Electro-deposition and Metal Finishing

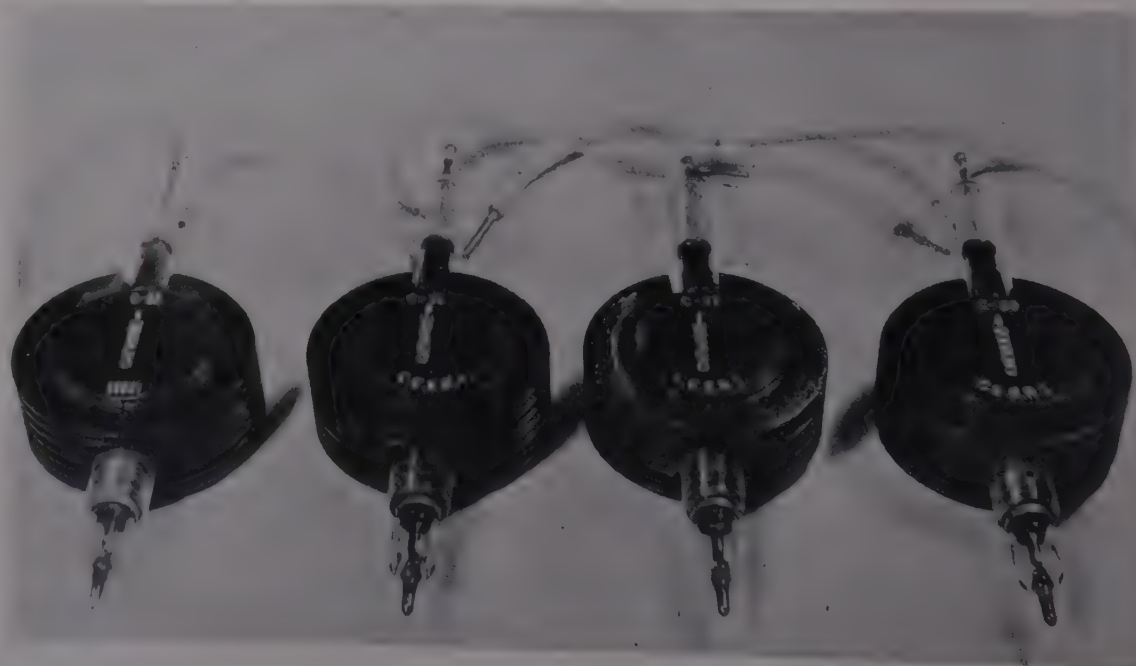
The effects of some organic addition agents on getting a decorative finish for copper and brass by anodic treatment in phosphoric acid solution were reported in a paper by H. V. K. Udupa

et al. B. A. Shenoi and coworkers presented three papers dealing with the development of a shear adhesion test for electrodeposits of metals, the influence of addition agents on the internal stress in nickel deposits and on the usefulness of the addition of glycine and molasses in obtaining 100% current efficiency for application in elapsed time indicators of the copper/copper sulphate type. A paper by H. V. K. Udupa *et al.* highlighted the advantages of the potentiometric method of estimation of zinc in the presence of cadmium in a supporting solution of oxalic acid. Two papers by Bhatki and coworkers of the Tata Institute of Fundamental Research, Bombay brought out the usefulness of urea-oxalate medium for the electrodeposition of carrier-free manganese-54, actinium-228, technetium-182 and tantalum-182. Some important parameters of the acid-cyanide process for plating gold-cobalt alloys for electronic applications were elaborated in a paper by W. H. Cleghorn of UK. K. S. G. Doss presented a paper on the effect of magnetic field on electro-deposition and electrothinning, giving a formulation for the circular motion of the electrolyte under the combined action of electric and magnetic fields. In dealing with the dimensional stability during heat process of electroformed

copper and nickel for wave guides, A. L. Redij reported in his paper that the Watts bath is more suitable for this purpose than the nickel-sulphamate bath and claimed to have fixed the parameters for getting distortion-free copper deposits.

CEERI Magnetron Passes CIL Evaluation Tests

Magnetron is a highly sophisticated valve which forms the heart of a radar system. In the presence of a suitable magnetic field and when a pulsed high voltage (several kilovolts) is applied, it generates high-power bursts of several hundred kilowatts to megawatts peak power of radio-waves of very short wavelength (a few centimeters or less, compared to the shortest wavelength of about 10 m received by a radio-receiver). These pulses of radio-wave energy are transmitted by the radar-antenna and received back as echoes when reflected by an aircraft, or some similar object coming in their way. In addition to the use of magnetrons in various types of radar systems used in military operations, they are used in systems which have important applications in civil aviation and meteorology. They are also now being increasingly used abroad in certain specialized industrial and domestic equipment.



Magnetrons of different types have been developed by CEERI Pilani, Type S-13, peak power output 500 kW, has passed CIL evaluation tests.

In view of the strategic importance and wide applications of magnetrons, the Central Electronics Engineering Research Institute (CEERI), Pilani, took up the development of such types of valves/tubes, and has completed indigenous design and development of a number of different types of magnetrons. To fulfil certain immediate requirements of a Defence user, CEERI has developed a magnetron of 500 kW peak power output (CEERI type S-13) to replace the equivalent imported magnetrons. Samples of this magnetron have successfully passed the stringent evaluation tests conducted by the Controllerate of Inspection Electronics (CIL) of the Ministry of Defence. They are now being batch-fabricated in CEERI for supply to the user. The cathode used in these magnetrons is a nickel-matrix type of cathode which was developed at CEERI. This type of cathode is more rugged, has longer life and gives higher pulsed emission-density than the conventional plain oxide-coated cathode.

Moulding Powder and Moulded Products from Agro-industrial Wastes

Thermosetting moulding powders, such as bakelite, are manufactured by mixing approximately equal amounts of phenol-formaldehyde resins, and fillers such as wood flour, paper, cloth cuttings, and asbestos, depending upon the end use of the final product. The process is not very competitive because of the high cost of phenol and formaldehyde.

The Regional Research Laboratory (RRL), Jorhat, has developed a process for the production of moulding powders and moulded products therefrom in which the use of formaldehyde is completely dispensed with. This process takes advantage of certain inherent constituents present in agro-industrial wastes which under certain conditions react with phenolic substances to give the resin for moulding purposes. The cost of production of the moulding powder by RRL process is estimated to be Rs 3000 per tonne whereas the market price of such

powder manufactured by the conventional process ranges from Rs 10 000 to Rs 30 000 per tonne.

The process developed by RRL, Jorhat consists in the comminution of agro-industrial lignocellulosic material to a powder followed by thorough mixing with a calculated amount of sulphuric or hydrochloric acid. The acid dust mixture is treated with phenol and digested in an autoclave at an elevated temperature for a definite period of time. The digested material is washed,

neutralized and compounded with filler, hardening agent and plasticizer, etc. to get the moulding powder. The powder can be moulded to any desired shape and size.

All the chemicals and equipments required for the process are indigenously available in the country. The total capital investment for a 1-tonne per day capacity moulding powder manufacturing unit will be about Rs 3.18 lakh and the return on investment is 66%.

PROGRESS REPORTS

CRI Annual Report : 1971-72

This annual report of the Cement Research Institute (CRI) of India (1971-72), the first report since the laboratory started functioning at Bhallabgarh (Haryana) in July 1971, shows that the institute has made considerable progress in the projects relating to : utilization of fly ash, development of rapid methods of analysis of cements and their raw materials, development of improved packaging for cement, design of high strength concrete mixes, and design of concrete poles. Nine sponsored projects have been completed so far, and work on 9 sponsored projects was continued. As many as 34 programmed R & D projects were on hand during the year.

A critical technical appraisal of the present state of knowledge on the scope of utilization of high magnesia limestone in the manufacture of cement has been prepared. Subsequent to the preparation of a working paper on the use of fly ash in reinforced cement concrete, work was taken up on the identification of deleterious constituents in Indian fly ash samples. It has been found that fly ash may contain soluble chlorides. Fly ashes collected from 10 different thermal power stations contained chlorides ranging from a few ppm to 800 ppm. Hence studies were made to find out if the introduction of fly ash as part replacement of cement in mortars would lead to corrosion of steel reinforcement. Experimental data point to the conclusion

that passive environments are formed around reinforcing steel rods in mortars with or without fly ash. Investigations are under way on the utilization of byproduct gypsum from fertilizer and chemical industries in the manufacture of cement. Since byproduct gypsum contains more than 90% $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ there is considerable scope for its utilization as a set-controller in the manufacture of portland cement. It has been found that for a satisfactory retardation of the cement clinker, byproduct gypsum corresponding to at least 1.75% SO_3 level is required as against 1.2% SO_3 level for natural gypsum. The byproduct gypsum was found to be more effective in controlling the final setting times in comparison to initial setting times which were relatively shorter for natural gypsum for corresponding SO_3 level. This appears to be due to the presence of acidic impurities in the byproduct gypsum.

Experimental conditions for the qualitative estimation of aluminium and iron in the presence of each other using xylenol orange as indicator have been worked out. The development of colorimetric and turbidimetric methods of estimation of minor elements and constituents present in cement and cement raw materials has been taken up. A method for the estimation of soluble chlorides has been standardized.

Design and development of improved packaging for cement is being

investigated. Study of the three widely used packaging materials, viz. jute, paper and plastics, has been made. Preliminary work in this direction has shown that economically feasible alternative materials could be : (i) a composite material with jute or hessian as the base fabric and a suitable plastic film as a laminate with or without a binder; and (ii) an entirely plastic bag, either plain or woven type.

Detailed studies for formulating recommendations on the methods of production of high-strength concrete in factory based mass production of standard precast concrete units using locally available materials are in progress. Investigations on the use of chemical admixtures, such as anhydrous sodium sulphate and chlorides of magnesium, barium and iron, for obtaining high early strength in concrete were continued. Of all the additives tried, barium chloride performs well as an accelerator without the deleterious effects attributed to calcium chloride. The concentration of chloride ions in this case being much less than in the case of calcium chloride, theoretically the corrosion of reinforcing steel in concrete is expected to be very much less.

A technical appraisal on concrete poles, covering the design, manufacture, erection, standardization and testing, is in the final stages of preparation. A state of art report on the behaviour of concrete arch dams under dynamic loads is being prepared. A computer programme to obtain the dynamic response of an arch dam due to a given earthquake is being prepared. This would enable the study of the dynamic characteristics of concrete arch dams and aid in the preparation of simple design aids. A review of the different types of concrete pavements and the methods currently in use for their design is being compiled.

BTRA Annual Report : 1971-72

The annual report of the Bombay Textile Research Association (BTRA), Bombay for 1971-72, eighteenth in the series since the inception of BTRA, has been brought out recently.

Investigations in carding have provided fresh information in regard to the effect of speeds of various carding elements and the settings on transfer efficiency and carding quality. Studies on combing of various types of popular Indian and foreign cottons have enabled the identification of those which give better upgrading after combing. Optimum drawing conditions when there are mechanical faults in the draw frames have been evolved. A critical comparison of the mill's ring frames and preparatory processes with BTRA pilot plant processes has enabled the identification of those areas where action is beneficial to get improved yarn quality. Studies have shown that the application of condenser on frames with double feed, whereby the strands would be kept together, would contribute to improved spinning performances as well as ring frame productivity.

A project on streakiness in rubia cloth has been completed. The findings are expected to serve as guidelines to the industry. The PL 480 project on curling and bursting of selvages has been concluded and a comprehensive report issued to the concerned authorities. The findings of the study have enabled member mills to improve selvage construction of fabrics.

A single-stage bleaching process in kier has been developed for cotton textiles. This process has the advantage of combining the three normal bleaching operations of desizing, boiling with alkali and the subsequent oxidation into a single operation. The process offers considerable scope for saving by way of reduction in the consumption of water and steam as well as in the time of treatment. Extensive trials have been conducted

in the mills and the results are encouraging. BTRA has also developed a process for the bleaching of polyester/cotton blended fabrics. The process incorporates the removal of size, purification of cotton and bleaching of polyester fibre and cotton in a single stage. There is appreciable reduction in the processing sequence. The entire purification and bleaching can be carried out in 2 to 2½ hr. The treatment can be effected in a pad-roll system or in jiggers. Mill trials have proved successful and many member mills have opted for this process. Another achievement of BTRA in this field relates to the development of a process for increasing the colour value in vat dyeings. The process is suitable for all categories of cotton textiles and results in improved colour value of the order of 15-20%, besides imparting better feel and lustre.

A significant contribution has been made in the application of direct (electric) current in vat dyeings. Studies have indicated that the consumption of hydrosulphite could be considerably reduced by employing electrolysis in the bath. Trials on the mill floor have shown that as much as 55% reduction can be obtained in the consumption of this costly chemical.

The development of a stop motion for doubling and twisting frames has enabled reduction of yarn waste, besides saving of labour by way of increased allotment of sides per operator. The design rights have been sold to a textile machinery manufacturer. Further, a twist sensor, working on the principle of fluidics, has been designed and developed so as to work in conjunction with a detwister in the cloth opening system.

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

Foundry Core Binder

Foundry core binder is specifically used by steel foundries to obtain moulded parts of high dimensional accuracy and finish. At present, synthetic resin based core binders are in the market. The de-

mand for this type of resin binder is not available. However, the product could capture a part of the present market of synthetic resin binders because of its cheapness and good performance. Further, its demand is likely to grow

in view of the increasing output by steel foundries of moulded parts of high dimensional accuracy.

The National Chemical Laboratory (NCL), Poona, has developed a process for the manufacture of foundry core binder based on cashewnut shell liquid (CNSL). The process consists in polymerization of CNSL in the presence of catalysts. The work has been conducted on 5 kg of finished product per batch. The product has been tested by a reputed firm in Poona, and has been found to be suitable for the purpose. Another firm has carried out consumer acceptability trials on the product, and found the product acceptable.

The raw materials for the manufacture of foundry core binder are: cashewnut shell liquid, catalysts, and sulphuric acid. Except for the catalyst, all the raw materials are available indigenously. Though imported, the catalyst is available in the market and is likely to be produced in the country in the near future. Lead-lined kettle with bottom outlet and stirring arrangement is the major equipment required for the manufacture of foundry core binder. This is either available indigenously or can be fabricated easily.

The laboratory has assumed one tonne per day plant as the economic plant size. The total capital outlay for a plant of this size has been estimated at Rs 2.94 lakh (Rs 90 000 on plant, land and building; and Rs 2.04 lakh as working capital). The cost of production works out at Rs 1.64 per kg.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Electronic Tachometer

Tachometer is a device used for the measurement and control of the speed on the rotating bodies. Various types of tachometer, such as mechanical, electromagnetic and stroboscopic types, are known. Mechanical tachometers are generally operated by fly-ball or gear actuating counters and have the inherent disadvantages of having

greater time lag to follow the rapidly fluctuating speed with a reasonable accuracy; also, they require frequent maintenance. They also need direct coupling with the shaft which may load the system. Electromagnetic types are mainly based on the principle of electric generator, which also require mechanical coupling with the shaft. In this also there is need for the maintenance of brush and bearings if they are employed for continuous measurement of speed. The stroboscopic type is not suitable for the measurement of varying speed and is never used for speed control purposes.

The electronic tachometer, developed by the Central Mechanical Engineering Research Institute (CMERI), Durgapur is based on the pulse technique in which electric pulses from a rotating body are generated in a reluctance type pickup at a frequency directly proportional to the speed of the rotating body. These pulses are converted through a solid state circuitry to a dc volt which is linearly and directly proportional to the frequency and is used for the continuous measurement, recording or switching at the preset speed levels of the rotating body. The tachometer can be used through either direct or indirect coupling with the rotating body. It can also be used for both local and remote monitoring. The proposed tachometer has wide applications in the field of measurement and control of rotational speed where accuracy, wide range and reliable operation by unskilled personnel are of primary importance.

The advantages of the device are as follows:

- (1) It is rugged and portable as it consists of solid state elements.
- (2) It can measure speeds of a wide range (10 to 25 000 rpm) in five different steps; higher or lower steps can also be provided.
- (3) As the pickup may be coupled electromagnetically with the rotating body, the loading on the system can be practically eliminated.
- (4) The information can be transmitted over a considerable distance

from the point of measurement. This facilitates indication on panel board and the operation for the controlling of speed from a remote point.

- (5) The instrument can be used to drive a recorder for continuous recording of speed-time characteristics of the rotating body.
- (6) The device has very good thermal stability, measurements can be carried out up to an environment temperature of 55°C.
- (7) As it has only a few movable parts, it has a very long life.
- (8) The instrument may be powered either through mains supply or by a dry battery.
- (9) The power consumption in the instrument is very low.
- (10) The instrument can be used in a close loop control system and has also facilities to control any other device at the preset speed level of the rotating body.

The demand for the instrument is presently met by imports, but with the availability of the indigenous device the demand is expected to be considerable, say 500 units annually.

One unit has been developed at CMERI and a prototype fabricated. Its performance has been found satisfactory.

Most of the components are general type transistors, resistors and capacitors which are available indigenously.

The cost of manufacture has been estimated at about Rs 700 per unit.

No special type of plant or machinery is required for the manufacture of this unit. Any well established electronic instruments manufacturing organization can produce the unit.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Electrochemical Preparation of Potassium Iodate

Potassium iodate finds application in the manufacture of iodized salt which is used for the control of goitre. It is also used as an analytical reagent.

At present there is no indigenous production of this compound and the entire demand is met through import.

The Central Electrochemical Research Institute (CECRI), Karaikudi, has worked out an electrochemical method for the production of sodium or potassium iodate from an aqueous solution of iodine in sodium hydroxide or potassium hydroxide. Either platinum or electro-deposited lead dioxide on graphite and/or carbon or magnetite can be used as anode. The usual practice of adding potassium dichromate to the electrolyte is avoided by the use of stainless steel cathodes covered with asbestos fibre. The process consists of (i) dissolving iodine in caustic potash solution, (ii) oxidation of the iodide to iodate, (iii) cooling of the cell product so as to crystallize, and (iv) filtering of the potassium iodate and recycling of the mother liquor to cell feed.

Based on the bench scale investigation, a large scale laboratory run, producing 250 g of sodium iodate per charge, was made several times using platinum anode. The results were reproducible on large scale trials. The product obtained is 99.99% pure.

Potassium hydroxide and iodine are the main raw materials needed in the process. Iodine will have to be imported.

The main items of equipment include: rectifier, electrolytic cells, centrifuges, drier, platinum anode, stainless steel plate cathodes, diaphragm materials, and water cooling unit.

The total capital outlay for setting up a unit of 6 tonnes per annum capacity has been estimated at Rs 2.00 lakh. The cost of production has been worked out at Rs 60 per kg.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Low-cost Paper Houses

About 80% of the population of India lives in temporary type of houses made of mud or bamboo, or in thatched huts. These huts and houses are not only unsafe but unhygienic also. When

millions of people are uprooted on account of floods, earthquakes and other natural calamities, the problem of providing temporary shelters to the displaced persons assumes utmost importance. The armed forces have also to be accommodated in temporary type of accommodation. There is thus a great demand for suitable low-cost prefabricated or in-situ houses for providing shelter to millions of people and for other emergencies. Even in USA due importance is being given to such type of houses while the developing countries of Asia and Africa are showing greater awareness to these problems and are taking considerable interest in such houses. Market for these houses may have to be created but once these houses become popular, there will be unlimited demand.

With a view to making it possible to build cheap houses from indigenously available raw materials, investigations were undertaken at the Regional Research Laboratory (RRL), Jorhat, and a design has been successfully developed. The low-cost houses developed at the laboratory are built from plain or corrugated board possessing suitable strength and other fire and water

resistant properties. Such boards can be prepared from cellulosic raw materials and waste papers. The process of board making consists of beating waste papers or other pulp in the presence of sizing material and subsequent sheet forming followed by drying. Corrugated sheet is produced by forming the sheet from the pulp stock, removing the excess water under pressure and then placing the sheet under suitable corrugated mould. The boards, plain or corrugated, are further subjected to surface sizing treatments for making them water-resistant. The boards, or corrugated sheets, can be made of suitable sizes and profiles for making prefabricated houses, which provide safety against wind and other loads, drainage and insulation. Such houses may not require any foundations but if the sheets or boards are plain, it would be necessary to provide a light-weight structure of timber/bamboo/angle iron. Flooring and other finishing can be provided according to individual choice. A system has thus been developed for the construction of prefabricated/in-situ low-cost houses which are quite durable and structurally safe and water- and fire-resistant. Such houses are



Low-cost paper house developed by RRL, Jorhat

easy to construct and provide economy in labour, transport, etc.

Waste paper, bamboo pulp and certain chemicals are the main raw materials for making the board and these are available indigenously.

The main items of plant and machinery are: vessel for emulsion preparation, beater, stock chest, strainer, cylinder mould, board-making machine, hydraulic press, corrugation mould and cutter. All these are available with the indigenous pulp and paper machinery manufacturers.

The expenditure towards machinery and equipment for a 5-tonne plant is estimated at Rs 4.5 lakh. The cost of sheet from waste paper amounts to Re 0.50 per sq ft. Depending upon the type of construction, the cost of paper house comes to Rs 3.00 to Rs 4.00 per sq ft.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

PATENTS ACCEPTED

Indian Pat. 126065

Improvement in or relating to the manufacture of activated carbons

K. Seshacharyulu, M. A. Sattar, K. S. Patil, P. S. Murti, E. R. Saxena & G. S. Sidhu RRL, Hyderabad

The conventional methods of producing activated carbons by gas/steam activation are based on: (i) fixed-bed vertical reactor in which the material to be activated is held in position and heated indirectly to the required temperature and the reacting gases are passed through the bed; or (ii) rotary kiln in which the material flows from one end of the kiln to the other in contact with hot gases/steam; or (iii) externally heated tubes in which the material is fluidized with activation gases/steam.

In the process covered by the patent under reference, the material is activated in an internally heated fluidized-bed reactor. In this method, better thermal efficiency and reaction conditions can be achieved. Materials like coal char, wood char-coal, and lignite can be

activated. Steam, combustion gases and/or air can be used as the fluidizing medium. The reactor is suitable both for continuous and batch operations.

The raw material is first reduced to a suitable size and charged into the reactor. The operating conditions are controlled in such a way that fluidized conditions are obtained. The charge is activated at elevated temperature after adjusting the partial pressure of steam and reaction time.

Indian Pat. 129134

Improvement in or relating to the electro-galvanization of steel wires

H.V.K.Udupa, R. Thangappan Nadar & S. Krishnamurthy
CECRI, Karaikudi

Electro-galvanized steel wires of different gauges are used as fencing wire, telegraph wire, and for making wire ropes and other commercial products. Apart from the indigenous production of galvanized wire quite a good amount of it is imported into India every year. In addition, substantial amount of galvanized steel strips is also imported.

Some of the disadvantages associated with the hitherto known processes are that very high current densities cannot be employed, the thickness of the deposit is not uniform throughout, and the requirement of the floor space for the unit is very high. Addition agents, if added, are to be closely controlled within certain limits and in that case electrolyte purification is an additional operation.

By employing the technique of inert material fluidization as well as forced circulation of electrolyte, a process (covered by the patent) has been developed for electro-galvanizing of mild steel wires of various sizes in acid type baths. The use of fluidized-bed and forced circulation of the electrolyte enables very high current densities of 300 to 500 amp/dm² to be employed, the zinc coating being bright, uniform and adherent onto the base.

As a result of this, the speed of the wire is to be maintained at very high

speeds of 10-75 m/min which in turn enhances the production manifold. Moreover, the fluidizing column-cum-galvanizer being a cylindrical vertical column, the space occupied by this is only about 1/10 of that of the conventional unit. There is also saving in zinc as the smaller thickness of coating obtained by this method is sufficient to withstand the environmental condition. This is due to the uniform coating thickness.

The new process will (i) help eliminate the import of galvanized wires, (ii) result in savings in zinc, and (iii) reduce the cost of galvanization.

Indian Pat. 129109

An apparatus for recording wind velocity
V. R. Bhawe

CPHERI, Nagpur

Wind speed directly controls the rate of dilution of air pollutants. For evaluating air pollution therefore, it is essential to record wind speed (and also wind direction) data of the region, and hence the need for a suitable instrument for collecting wind speed data. Most of the wind speed recorders in use are not suitable for field work. Some of them are not handy and their installation is comparatively time-consuming. Some require electrical power for operation.

The device covered by the patent is suitable for field work as it is compact, occupying only 4 ft² installation area. The installation of the instrument is simple, its operation is entirely mechanical, requiring no electrical (battery or mains) power. The instrument is an integrating type and records wind run in the form of lines corresponding to the continuous rise and fall of the pen, the rate of rise being proportional to the wind speed. The average wind speed and total wind run can be easily calculated from the records. The instrument gives 24 hr record in one setting.

PATENTS FILED

1226/72: Improvements in or relating to the production of oxalic acid from sugarcane molasses, S. B. Chaudhuri & M. S. Iyengar—RRL, Jorhat.

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Advertisement No. 2/73

It is proposed to appoint a Director to head the Central Indian Medicinal Plants Organization, Lucknow.

Job Requirements: It is a top management post in research, development, introduction and intensive cultivation of medicinal and aromatic plants and production, processing and utilization of their products with emphasis on promotional and related work. The Director is required to provide high level leadership in the formulation of programmes and projects, organizing and coordinating team work to secure rapid progress in the attainment of the objectives of the Organization.

The main scope and functions of the Organization are:

- (i) research, developmental, promotional and related work on cultivation, production, processing, utilization and marketing of medicinal and aromatic plants and their products;
- (ii) in collaboration with other agencies, introduction, acclimatization (including measures for prevention and control of pests and diseases) of exotic species and also production of authentic high-yielding seeds, leaves and other propagating materials of medicinal and aromatic plants of economic importance;
- (iii) surveys of resources of medicinal and aromatic plants and maintenance of economic statistics of the raw materials as well as the finished products; and to set up and maintain a specialized herbarium and museum of medicinal and aromatic plants of economic importance.

Besides the above functions of the Organization, the Director will be overall in-charge of CIMPO Drug Farms and Factories in various parts of the country.

Qualifications/Experience: There is no standard application form prescribed as such. The candidates must provide proof of their academic level, experience and management ability consistent with fulfilment of job requirements specified above.

Scientists interested may obtain a standard proforma for sending their *curriculum vitae* from the Secretary, Council of Scientific & Industrial Research. They can also obtain a brochure on the aims and objects and the latest annual report of the Organization (CIMPO).

Salary/Conditions of Service: There are five salary scales ranging from Rs 1600 to Rs 3000 for the post of Director in Central Indian Medicinal Plants Organization of the CSIR. Persons selected may be fixed in any one of these scales according to individual merit.

The person selected will be appointed on contract for a period of six years, subject to confirmation of the contract after two years of satisfactory service. Other conditions of contract will be supplied on request.

Age Limit: Below 50 years, relaxable in special cases.

All correspondence in this regard may be addressed to the Secretary, CSIR, Rafi Marg, New Delhi 110001 and the completed *curriculum vitae* proforma must be received in this office on or before 9 April 1973.

Advertisement No 3/73

It is proposed to appoint a Director to head the National Botanic Gardens, Lucknow.

Job Requirements: It is a top research management post in the domain of economic botany with special emphasis on plants of industrial value and the development and maintenance of botanical gardens in the country. The Director is required to provide high level leadership in the formulation of research and development programmes and projects, organizing and coordinating team work to secure progress in attainment of the objectives of the Institute. He will have the overall responsibility for the work of the Institute and for creating an atmosphere conducive to creative work. The chief functions of the Garden may broadly be stated as collection, introduction and propagation of ornamental plants, botanical, horticultural and phyto-chemical researches on economic plants, maintenance of botanical gardens, setting up of herbaria and botanic museums, specially of economic plants, and identification, supply and exchange of plants and plant materials.

Qualifications/Experience: There is no standard application form prescribed as such. The candidates must provide proof of their academic level, research and development experience and management ability consistent with the fulfilment of job requirements specified above.

Scientists/Technologists interested may obtain a standard proforma for sending their *curriculum vitae* from the Secretary, Council of Scientific & Industrial Research. They can also obtain a brochure on the aims and objects and the latest annual report of the Institute.

Salary/Conditions of Service: There are five salary scales ranging from Rs 1600 to Rs 3000 for the post of Directors in the national laboratories/institutes of the CSIR. Persons selected may be fixed in any one of these scales according to individual merit.

The person selected will be appointed on contract for a period of six years, subject to confirmation of the contract after

two years of satisfactory service. Other conditions of contract will be supplied on request.

Age Limit: Below 50 years, relaxable in special cases.

All correspondence in this regard may be addressed to the Secretary, CSIR, Rafi Marg, New Delhi 110001 and the completed *curriculum vitae* proforma must be received in this office on or before 9 April 1973.

Advertisement No. 4/73

It is proposed to appoint a Director to head the Central Salt & Marine Chemicals Research Institute, Bhavnagar.

Job Requirements: It is a top research management post in the field of industrial research and development pertaining to Marine Chemicals. The Director is required to provide high-level leadership in the formulation of R & D programmes and projects, organizing and coordinating team work and assuring commercial utilization of the results of research. He will have the overall responsibility for the work of the Institute and for creating an atmosphere conducive to creative work. The main objects of the Institute are research and development: (a) towards the improvement of the salt industry, (b) for the utilization of byproducts from marine and inland lake bitters, and (c) for recovery, production and utilization of marine chemicals. The Institute also carries out research on desalination of water, use of sea-water for agriculture and exploitation of seaweeds and algae as sources of food and chemicals.

Qualifications/Experience: There is no standard application form prescribed as such. The candidates must provide proof of their academic level, industrial R & D experience and management ability consistent with the fulfilment of job requirements specified above.

Scientists/Technologists interested may obtain a standard proforma for sending their *curriculum vitae*. They can also obtain a brochure on the aims and objects and the latest annual report of the Institute.

Salary/Conditions of Service: There are five salary scales ranging from Rs 1600 to Rs 3000 for the post of Directors in the national laboratories/institutes of the CSIR. Persons selected may be fixed in any one of these scales according to individual merit.

The person selected will be appointed on contract for a period of six years, subject to confirmation of the contract after two years of satisfactory service. Other conditions of contract will be supplied on request.

Age Limit: Below 50 years, relaxable in special cases.

All correspondence in this regard may be addressed to the Secretary, CSIR, Rafi Marg, New Delhi 110001 and the completed *curriculum vitae* proforma must be received in this office on or before 9 April 1973.



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Seminar on Lime Manufacture & Uses

A seminar on Lime Manufacture and Uses, organized by the Central Building Research Institute (CBRI), Roorkee in collaboration with the Lime Manufacturers' Association, the National Buildings Organization (NBO) and the Working Group on Building Limes, was held on 16 and 17 November 1972 in New Delhi. Attended by more than 100 delegates, the seminar consisted of three technical sessions besides a concluding session. In the first session five papers were presented. The first paper on 'Composite mortars and plasters' (N. Macedo; Dyers Stone Co. Pvt. Ltd, Delhi) laid emphasis on the usefulness of composite mortars and plasters and the desirability of proper designing, keeping in view the specific needs. The second paper 'Economy in building construction through use of lime' (G. D. Bhide; NBO, New Delhi) showed that a saving of 4 to 7% could be achieved through large scale use of lime.

Research work carried out at CBRI during the last four years on magnesian limes was summarized by N. G. Dave and I. Masood. The paper demonstrated the possibilities of use of this material in building construction in India. Studies on the effect of light and heavy magnesia on the properties of lime, discussed by R. K. Ghosh, C. S. Pant and R. C. Bhatnagar (Central Road Research Institute, New Delhi), also confirmed the possibilities of the use of this material. The principles and practice of manufacture of hydrated lime were set out by N. G. Dave, S. P. Mehrotra and M. Khalid of CBRI in their paper; the paper also described the experiments on the manufacture on

a pilot scale, performance characteristics and the keeping properties. The paper pointed to the vast potential of hydrated lime in building construction.

Two papers in the second session, viz. 'Use of lime in stabilized soil road construction' (R. L. Nanda; CRRI, New Delhi) and 'Construction and improvement of roads in northern India using lime-soil stabilization specifications' (J. S. Gill; Capital Project, Chandigarh) dealt with the subject of stabilization of roads through the use of lime. Whereas the former discussed the technique of soil stabilization, the latter described a case study of the application of the technique. Another paper, 'A new packaging material for limes' (S. K. Jain; Hoechst Dyes and Chemicals, Bombay), dealt with new types of woven bags made out of high density polyethylene for packing limes. As lime is a perishable material, a plea for providing rapid transport was made in a paper presented by S. N. Beri (Satna Stone Lime Co., Satna). Lime has been used widely as the cheapest alkaline material for the treatment and disposal of industrial wastes (P. V. R. Subramanyan, M. V. Srinivasan & G. J. Mohanrao; Central Public Health Engineering Research Institute, Nagpur).

The third session included a paper on 'Advanced system of mining limestone in India' (M. S. Vig; Birla Stone Lime Co., Birimitrapur, Orissa). In this paper the author put up a scheme for mechanized mining of limestone and considered that a unit producing 40 000 million tonnes of limestone per month should be viable.

The employment generating capacity in the lime industry was discussed in

one of the papers presented at this session. N. G. Dave and I. Masood (CBRI) described in detail the studies undertaken by them on the various types of lime kilns and gave details of the design and operational practices. They pointed out the drawbacks and suggested some lines of improvement.

The difficulties of the manufacturing industry as well as of the users were put forth in some detail. Both manufacturers and users endeavoured to understand the view points of each other and tried to find solutions to the various problems. As a result of discussions, a number of recommendations pertaining to research, administration, manufacture, and other aspects were made. The recommendations were discussed in detail in the concluding session and it was decided that the Working Group on Lime should take the necessary follow-up action. Among the subjects recommended for being taken up at CBRI were: (i) improvement in the working efficiency of medium sized shaft kilns through instrumentation, mechanization, etc.; (ii) development of suitable equipments for the hydration of calcium and magnesian limes; and (iii) development of methods for utilizing lime kiln wastes.

WHO Regional Seminar on Air Pollution Control

A regional seminar on Air Pollution Control was organized by the World Health Organization in collaboration with the Central Public Health Engineering Research Institute (CPHERI)—a WHO Regional Reference Centre for Air Pollution Control—at CPHERI, Nagpur from 4 to 14 December 1972.

Various technical and administrative problems concerned with air pollution

control were discussed at the seminar, which was attended by some 45 delegates from different countries of South East Asia.

The consensus of the seminar was that air pollution problems could be solved only through intensive research and development of indigenous equipment supported by firm legislation, effective administration and the active cooperation of an enlightened and determined public in raising their voice against pollution.

Various issues on air pollution control programmes such as the behaviour of pollutants after emission, the factors affecting their behaviour, and the methods of assessment and techniques of measurement were discussed. The effect of pollutants on the health of the receptor, the need for its control and the various theories of control also came up for discussion. The participants made constructive suggestions as to how a programme could be made effective by utilizing existing laws, local agencies and other organizational set-ups in their countries.

The formation of a regional set-up to discuss planning, standardization of methods and procedures, emission standards, training, etc. was described as an effective method for fostering air pollution control in South East Asia. The seminar also suggested stepwise approach to air pollution control in the South East Asia region.

Applications of Photography in Engineering & Science : Seminar

The role of photography as an integral part and parcel of the investigation process rather than as a merely supporting tool in recording information, collection and dissemination was the theme of a seminar on 'Applications of Photography in Engineering and Science' organized by the National Aeronautical Laboratory, Bangalore from 11 to 13 December 1972. Seventy delegates representing 30 organizations like defence laboratories, institutes of technology, engineering colleges and

polytechnics as well as the photographic trade and industry participated in the seminar.

The subject matter embraced the fields of flow visualization, combustion and chemical processing studies, holography and its application to vibration and stress analysis, aerial photography and photogrammetry, high speed photography and photographic methods in integrated circuitry and printed circuits and equidensitometry. Twelve lectures on various aspects of photography were delivered. An exhibition on photo

techniques employed in science and engineering was also organized.

In the final session it was recommended that a central photographic unit, which would provide a country-wide brains trust, pool of equipment, specialists, materials and skilled technicians, should be set up at the National Aeronautical Laboratory. The unit would also conduct courses on photography oriented to the needs of science and technology in the country, besides acting as an information, collection and dissemination centre.

Awards for Import Substitution and Inventions

Nine processes/products developed by CSIR laboratories and industrial research associations have been selected, among others, for the Inventions Promotion Board's awards announced on the Republic Day (1973). Details of the inventions, the inventors' names and the nature of awards are as follows :

Import Substitution Awards

1. Development of indigenous know-how for the production of microwave components—Dr Kailash Chandra, Dr Ram Parshad, Shri V.K. Agarawal & Shri H.M. Bhatnagar, National Physical Laboratory (NPL), New Delhi : Cash award of Rs 1000 to each of the inventors. (NPL and K.L.B. Electronics, New Delhi were awarded a bronze shield each earlier).

2. Development of a process for the production of synthetic anhydrous potassium cryolite—Sarvashri V. Aravamuthan, G.N. Kannan, P.S. Desikan, K.S. Srinivasan, N. Balasubramanian, S. Ramamurthy & K.V. Rangaswamy, Central Electrochemical Research Institute (CECRI), Karaikudi; Certificate of merit to each of the inventors.

3. Development of a process for the oxidation of starches with hypochlorite for the preparation of oxidized starches—Sarvashri H. U. Mehta, H. C. Srivastava & P. C. Mehta, Ahmedabad Textile Industry's Research Association (ATIRA), Ahmedabad: Certificate of merit to each of the inventors.

4. Development of wire resistance strain gauges—Shri B. S. Dasannacha-

rya & Shri K. Krishna Murthy, National Aeronautical Laboratory (NAL), Bangalore : Certificate of merit to each of the inventors.

Invention Awards

5. Development of a tubular type plant to separate water and other solvents from solution—Shri A. S. Kane, Dr M. V. Chandorikar & Dr D. J. Mehta, Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar: Joint cash award of Rs 3000.

6. Development of new detector tubes for hydrogen sulphide—Dr A. K. Ghosh & Shri N. N. Banerjee, Central Mining Research Station (CMRS), Dhanbad: Joint cash award of Rs 1500.

7. Development of continuous tea fermenting machine—Shri D. N. Barbora, Tocklai Experimental Station, Tea Research Association (TRA), Jorhat : Cash award of Rs 1500.

8. Improvements in or relating to the preparation of calcium tungstate blue phosphors—Dr C. V. Suryanarayanan, Shri M. I. A. Siddiqi, R. Laxminarayanan & Shri N. Rajaram, Central Electrochemical Research Institute (CECRI), Karaikudi; and Shri S. Balachandran (Indian Railways) & Shri R. Kalyanasundaram of Government College, Salem : Joint cash award of Rs 2000.

9. Improvements in or relating to the preparation of sintered cadmium sulphide photoconductive cells—Dr C. V. Suryanarayanan & Sarvashri

N. Rangarajan, K. Nagaraja Rao & M. J. Chockalingam, Central Electrochemical Research Institute (CECRI), Karaikudi: Joint cash award of Rs 1000.

Brief accounts of two of the inventions follow; others will be published in the forthcoming issues.

Hydrogen Sulphide Detector Tube

Developed by the Central Mining Research Station (CMRS), Dhanbad, the detector tube is a device for accurate spot detection and estimation of hydrogen sulphide gas which is poisonous, highly inflammable and irritating to eyes. The detector finds application in various industries, such as mining, rubber vulcanization, viscose rayon, petroleum refineries, coke ovens and byproducts, poultry, feather and wool processing, tar distillation and tanneries; and in naptha cracking and sewage treatment plants.

At present the detector tube for spot detection and estimation of hydrogen sulphide gas is being imported. The colouration produced after reaction in most of these tubes does not appear to have sharply defined edges to permit reading with accuracy.

The detector developed by CMRS consists of a 16 mm pyrex glass tube and contains a 3 mm diam. and 20 mm long column followed by a column (5 mm diam. \times 110 mm long) of silica gel impregnated with bismuth nitrate solution stabilized with mannitol. Bismuth nitrate is used for the first time in this type of tube as the reacting chemical and specially treated silica gel as the granular material. Because of the extremely low solubility product of bismuth sulphide, it has a high sensitivity for the detection of the gas. Another special feature of the new method is the controlled deactivation of the purified gel which produces silica gel of reduced surface area, thereby facilitating the linear spreading of the colouration when employed as the base material for impregnation. The contrast of deep brown colour with the bright white gel of the unreacted column is an additional advantage, permitting easy detection and estimation of the gas.

The cost of production of the tube has been estimated at about Re 0.50 per unit; an imported tube costs about Rs 4.

Continuous Tea Fermenting Machine

Designed and developed by Tocklai Experimental Station of the Tea Research Association, the continuous tea fermenting machine is a single circuit endless chain type machine with two endless chain-circuits one on each side of the trays, which the chains haul along the tracks provided for the purpose.

The trays remain flat and horizontal on the upper run and are designed to travel through a sealed chamber which is compartmentalized into two sections. The duct below the horizontal top run of the trays is meant to serve as the return air duct as well as the section in which air-washing facilities are provided to remove heat from the volume of recirculating air and/or for humidification of the same volume of air. The top of the compartmentalized chamber is connected by means of suitable air ducts to an axial flow fan which is fitted with a reversible switch. The arrangement is such that the flow

pattern is flexible to allow upward or downward air flow through the leaf on top tray run at the beginning of the period of fermentation.

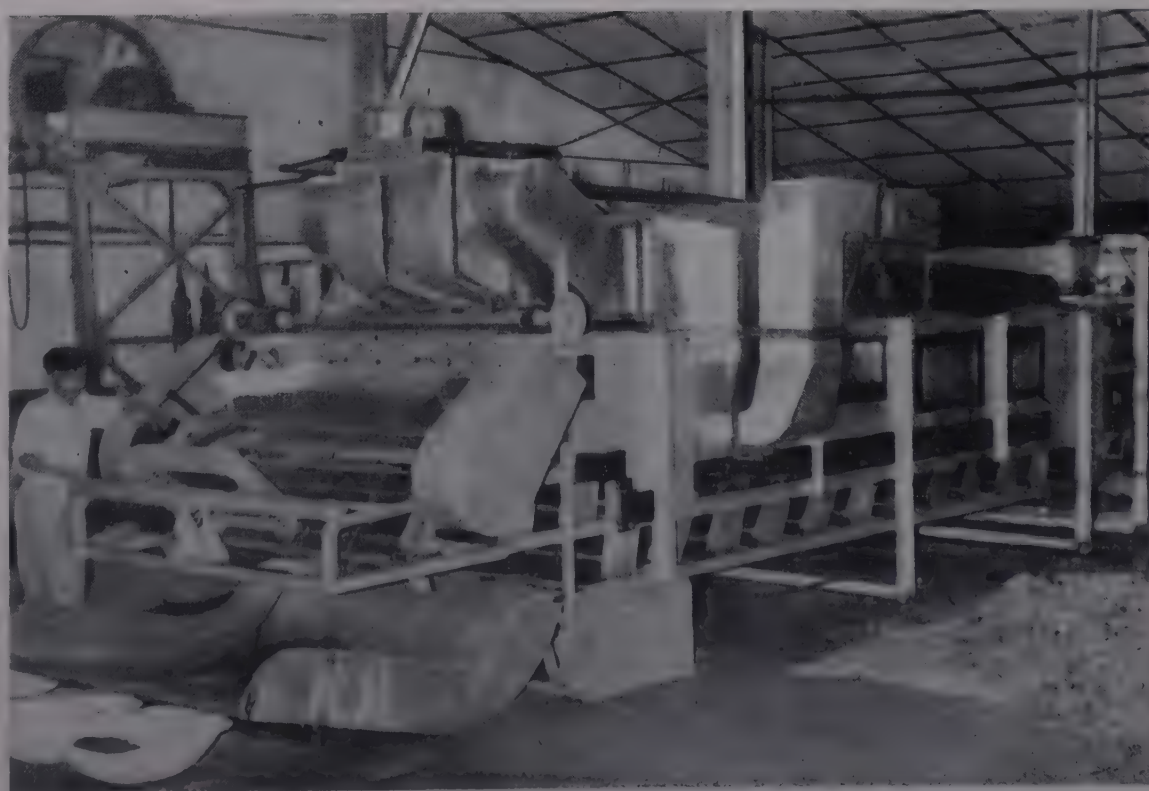
The feed hopper at the feed end of the machine is fitted with a grid of epoxy resin-painted flat iron construction and is actuated by a vibrating motor from one end. This is done to de-ball the leaf fed into the trays of the fermenting machine.

Flap type valves are used for sealing the entry of air from outside or to the suction from the pressure chamber.

At the discharge end, the load of leaf fed onto the trays is discharged, and the tray frames are made to bump against spring loaded buffer to knock off the sticky particles of leaf from the wire mesh tray top.

The trays remain suspended from the pins provided on the chain on their return run duly supported by wheels and rollers. This position is considered ideal to make washing or cleaning of the trays by pressure hoses either pneumatically or hydraulically.

The chain and the sprockets at the drive end are designed to provide a speed ratio of 3:1. The fastest speed required for the top trays run through the chamber is 35 min and the slowest



Continuous tea fermenting machine designed and developed by Tocklai Experimental Station of Tea Research Association

is 1 hr and 45 min, which should be ample for any type of tea manufacture in North-Eastern India.

An oxygen injecting nozzle is provided at the top air duct. Oxygen has to be provided into the recirculating air streams via a medical type of oxygen regulator regulating the flow of oxygen between 1 and 10 litres/min.

Krishnan Medal for Shri D. Gupta Sarma

The Krishnan medal 1972 for outstanding contribution to geophysics has been awarded to Shri D. Gupta Sarma of the National Geophysical Research Institute, Hyderabad. The medal was presented by Dr K. R. Ramanathan of the Physical Research Laboratory, Ahmedabad, at a function held at NGRI on 29 December 1972 on behalf of the awarding committee.

After a brilliant academic career leading to the M. Sc. degree of the Calcutta University in radio physics and electronics, Shri Gupta Sarma began his research career in 1958 at the Institute of Radio Physics and Electronics, Calcutta. In 1956 he joined the Geological Survey of India and did some pioneering work on the indigenous development of geophysical instrumentation.

Moving to NGRI in 1965 as Assistant Director, Shri Gupta Sarma continued instrument development work, producing six types of prospecting instruments. These instruments are being batch produced at the institute for sale to users. Shri Gupta Sarma is also largely responsible for the development of: (i) an electromagnetic modelling apparatus based on a new pulse sampling technique; (ii) an airborne proton magnetometer system which has been used for mineral surveys; (iii) a rubidium vapour magnetometer for airborne and ground use; and (iv) marine magnetometer.

Shri Gupta Sarma is currently engaged in the development and fabrication of an airborne pulsed electromagnetic prospecting system which is expected to be better than similar systems available abroad.

Areas of Scientific Collaboration between India and Arab Republic of Egypt Identified

The Joint Scientific Board of India-Arab Republic of Egypt, which met recently in New Delhi, identified the areas of research in which the two countries will cooperate in the years 1973 and 1974. The areas of research are: production of protein from conventional and non-conventional sources; pesticides; leather tanning and technology; beneficiation of low grade iron ores; and food canning and dairy.

The two countries will also exchange research workers.

The Egyptian delegation was led by Dr Mahmoud A. Hassan, Chairman of the Industrial Research Council, Academy of Scientific Research and Technology, Egypt and the Indian delegation by Dr Y. Nayudamma, Director General, Scientific and Industrial Research. The working plan was signed on 2 February 1973 by Dr Mahmoud A. Hassan, leader of the Egyptian delegation, and Dr G. S. Sidhu (Director, Regional Research Laboratory, Hyderabad), deputy leader of the Indian delegation.

PROGRESS REPORTS

CBRI Annual Report : 1971

The annual report of the Central Building Research Institute (CBRI), Roorkee for 1971 has been published. A perspective plan of building research to be carried out at the institute for the next decade, formulated in collaboration with the building industry, was a major achievement of the laboratory. The 90-page (royal 8vo) report also reveals that CBRI played a significant role in coordinating building research amongst the ECAFE region countries.

Foundations for about 3200 houses and for several structures such as transmission line towers, traction towers and masts were constructed with under-reamed piles, leading to significant economy in cost. Bricks of improved quality were produced from saline soils of Haryana in collaboration with a kiln owner. Processes were also developed for the manufacture of bricks of superior quality from clayey and silty loams of Manipur and Assam. Details of a mechanized plant and the technology of production of bricks by semi-dry pressing were worked out. This would be helpful in the manufacture of bricks from sandy soils that cannot be extruded due to lack of plasticity. Successful factory trials were carried out on the production of large-size corrugated clay sheets. A process was developed for the production of lightweight clay bricks, blocks and tiles,

and field trials for the manufacture of clay bonded fly ash bricks were conducted.

A fluidized-bed furnace was designed and fabricated for the exfoliation of vermiculite and operational conditions for the production of bloated clay aggregate were optimized. Field trials of latex-silicate treatment for damp-proofing of existing buildings were carried out. A process was also developed for producing cement clinker using fly ash in place of clay. It enables the production of clinker with magnesium oxide content up to 6% without causing unsoundness in the final cement.

Economical designs of antenna tower foundations on under-reamed piles were prepared for the Indian Railways. Under-reamed piles were also used for transmission line tower foundations in the Beas Project. Compaction under-reamed piles were recommended for use in place of conventional foundation for the floor of ore tipplers at the Haldia Dock Project. In another live project of the Ship Building Yard at Calcutta, the use of double under-reamed piles was recommended as an alternative to the more costly conventional designs. A simple technique for pile driving was developed which is suited for foundations for residential buildings in poor soil conditions such as are met with in the Calcutta region.

A vademecum was developed for

providing simplified design aids for quick determination of fenestrations for daylighting. Another design aid in the form of a polka-dot-cross diagram for the Indian clear sky was also worked out.

Performance rating and classification of roof and wall sections in hot-dry climates was evolved. It provides a basis for thermal performance evaluation of building section under typical climatic exposure conditions of a region.

Climatic design data for eight important cities in the country were collected and analyzed. The data will aid air-conditioning industry in estimating summer cooling load.

The impact noise rating of resilient floors built in sandwich construction with several indigenous resilient materials was determined. The data provide, under Indian conditions, the basis for rating floors for isolation of impact noise.

A project proposal for large panel prefabricated housing was prepared for the Delhi Development Authority. Precast concrete panels of L-shape were developed for semi-permanent houses. A detailed study was made on the influence of mix proportions, grading of aggregate and curing conditions on the physical properties of hollow concrete blocks made of crushed stone aggregate. Various causes of the cracking of block masonry during the construction stage were identified and remedial measures, which would help in revising the existing code, were formulated.

A process for mechanized production of the cored roofing/flooring units was developed. An equipment was designed and developed for spraying foamed polystyrene beads along with a liquid resin which has good thermal insulation. Field trials were conducted on the improved method of plastering by the use of gadgets developed for the purpose. The method led to an appreciable increase in the output of plastering on brick wall as also on ceilings.

Space requirements for science laboratories in higher secondary schools were worked out. A detailed analysis of curriculum, enrolment pattern,

nature of elective subjects, size and nature of teaching groups and other factors was also carried out for different enrolments in higher secondary schools. It has been found that a space economy of 15 to 20% is possible in class room spaces. For system-built schools, prefabricated flat roof schemes were studied with a view to achieving economy, flexibility and speed in the construction of schools.

Socio-economic aspects of households living in squatter settlements were studied to decide on the planning criteria and users' requirements in rehousing schemes of such settlements. Plans for one- or two-roomed dwellings were developed in collaboration with the Gujarat Housing Board for construction under the Low Income Group Housing Scheme.

A fire-retardant chemical, which is specially suited for wood and other materials, was developed.

Some of the CBRI processes utilized were: bored compaction piles; single stack system of plumbing; thin lintels; precast roofing and flooring units; single thickness walls; RCC frames for doors and windows; lime kilns; and high draught brick kilns. Licences were granted to several new firms for commercial production of brick extrusion machine, manual and powered scaffold hoists, and unit frame scaffolding. Licences were also granted for constructing lime kilns and high draught brick kilns, based on the designs supplied by the institute.

Six patent applications were filed: (i) coconut husk chipping machine; (ii) method of making gypsum plaster retarder; (iii) automatic cutting table; (iv) light-weight clay bricks, blocks and tiles for insulation and multistoreyed construction; (v) large size clay products with improved strength; and (vi) production of cement clinker from fly ash. The patent relating to an improved method of constructing compaction piles was accepted. Fifty-eight research papers were published.

SERC Annual Report : 1971-72

The annual report of the Structural Engineering Research Centre (SERC),

Roorkee for 1971-72 has been published.

An important achievement of the centre relates to the preparation of a revised document entitled 'Recommendations for a Unified Code of Practice for Structural Concrete'. The revised recommendations made in this document were discussed at a meeting organized by the Indian Standards Institution in collaboration with SERC for effecting modifications to the current codes on reinforced and prestressed concrete. The revised document gives specific recommendations in respect of load factors, limit state of deflection, permissible diameters in class IV structures, effective length of columns, splicing of bars, and limit state of collapse for class I, II and III structures.

A project of considerable importance which was completed during the year concerns the flexural behaviour of partially prestressed concrete members. The results of the investigation reveal that the beams in the ranges of 40-60% prestress possess smaller crack widths, less camber, and show better behaviour. An experimental structure using three pre-tensioned and three post-tensioned class III beams has been put up and the long-term behaviour of the beam is under study.

Another notable achievement was the development of a problem-oriented language, STEEL (Structural Engineers' Easy Language). This can be used for the analysis of all types of frameworks, including the rigid-jointed and pin-jointed plane and space frames by structural engineers with no knowledge of computer programming languages. A reference manual giving details of using this compiler has been brought out to enable structural engineers to solve their problems.

Investigations on the behaviour of concrete members reinforced with Grip bars under dynamic loads were continued and tests to study the cracking characteristics of such members were completed. The investigations on grain structures continued to make good progress. The test results on the model silo, fabricated by the centre, have been encouraging. The model is being

subjected to extensive experiments with wheat to ascertain the loads exerted on its walls during filling, in fully-filled and under emptying conditions. The model will be tested with rice, paddy, maize, jowar, bajra, gram and other materials. The results of research are expected to find application in the safe design of silos. Based on the results, a code of practice for the design of silos for storing various foodgrains will be prepared. The centre has already developed computer programmes for economical design of commonly used circular silos.

Two important investigations taken up during the year relate to the analysis of structures using the finite element method, and analysis of towers, multi-span bridges, etc. by the transfer matrix method. Development work on the computer analysis and design of guyed towers has also been started. The Regional Centre at Madras continued to make rapid progress on the project on prestressed concrete sleepers, and a preliminary report covering the investigations carried out on sleepers was sent to the Research Designs & Standards Organization, Ministry of Railways, Lucknow, at whose instance the investigation was taken up. The use of slotted end plates for the sleeper moulds and spiral mild steel reinforcement under the rail seats has been suggested for minimizing the labour and increasing the production rate in the long-line manufacture of sleepers. The need for the gradual release of prestressing force and the desirability of obtaining a minimum transfer strength of 400 kg/cm^2 at the time of release have been confirmed by tests on a large number of sleepers.

Under a project sponsored by the Department of Atomic Energy, the construction of the structural model of the prestressed containment vessel for the Atomic Power Project at Kalpakam was under way. A smaller model was constructed, prestressed, and pressure-tested to study the problems involved in the arrangement of cables, three-dimensional prestressing and in applying air pressure on such models. The experience gained from this test was

found to be very useful in the construction of the 1/12 scaled model.

The waffle-shell system, developed by the centre for the construction of roofs and floors of building, found wide acceptance and application. Two large housing projects at Madras and Tiruchirapalli have been completed using this system during the year under review. Encouraging results have been obtained on the use of fly ash in the preparation of medium and high strength concrete suitable for reinforced and prestressed concrete work. The material cost efficiency, which is defined as the ratio between the relative

strength of fly ash concrete with respect to the strength of concrete without fly ash and the relative cost of fly ash concrete with respect to that of the concrete without fly ash, has been studied for M200 and M420 concrete using fly ash. It is seen that the highest material cost efficiency is obtained for the ratios of fly ash to cement varying from 0.10 to 0.15.

A patent application relating to improvement in Grip bars for concrete reinforcement was filed. Seventeen research papers were published; 10 papers were presented at symposia/conferences.

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

Correction Paper

Considerable wastage of stationery occurs due to mistakes while typing. By using the special 'correction paper' developed by the Regional Research Laboratory (RRL), Jorhat, typing errors both in the original and in carbon copies can be corrected; this would save not only valuable stationery but also retyping time.

The process consists in coating sized paper or grease-proof paper with a special chemical mix prepared from indigenously available commercial grade chemicals. The coated paper is dried and cut into proper size and packed.

Samples prepared on a laboratory scale compare very well with imported ones, and have been found very useful. A box containing 10 pieces of paper of size $2.5 \times 6 \text{ cm}$ can be produced for 10 paise.

The coating machine, which is the major item of equipment, can be fabricated in the country. The scheme may need a fixed capital investment of Rs 45 000 and a working capital of Rs 10 000 per annum. The profitability is very high (80%). A plant for making 5000 boxes per day (containing 10 sheets of $2.5 \times 6 \text{ cm}$) is suggested.

Further particulars may be obtained from : The Managing Director,

National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Thermographic Paper

In recent years, the technology of copying and duplicating processes has assumed considerable importance. In USA alone it is reported that the sale of copying materials and machines exceeds over a billion dollars per annum. The major processes in the duplicating and copying fields are thermography, blue print, diazo process, and stencil and split duplicator. In India, these techniques are being introduced only recently in business and industrial houses, government and other offices.

The thermographic processes broadly fall into physical and chemical processes. In the physical process, coloured base paper is coated on one side with non-transparent fusible particles. When the hot stylus of a recording system passes over such a paper the coating melts and the base becomes visible. Data regarding the exact requirement of this type of paper are not available but with the introduction of advance techniques in industry, it is expected that the requirement will gradually increase. The Atomic Energy Commission is using thermographic paper for recording purposes. There seems to be a possibility of exporting

this paper to other developing countries also.

The Regional Research Laboratory (RRL), Jorhat, has developed a coating composition for making thermographic paper for use in a recording system. A solvent coating composition consisting of heat-fusible white particles and a binding agent has been evolved. When the coating is applied on one side of the coloured grease-proof paper, thermographic paper is obtained. The process has been developed on a laboratory scale.

Grease-proof paper, solvent and chemicals are the major raw materials required for the production of thermographic paper. All the chemicals required are produced in the country.

Coating machines, driving rolls, cutting machine and vessels fitted with stirrer for mixing are the important items of plant and machinery. All are available indigenously.

The capital outlay for a plant of 100 kg per day capacity has been estimated at Rs 4.20 lakh (Rs 3 lakh for building, machinery and equipment, and Rs 1.20 lakh as working capital). The production cost of the thermographic paper without graphic print is estimated at Rs 12.70 per kg; the cost of the imported thermographic paper with graphic print is Rs 20-50 per kg.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Grease-proof and Glassine Papers

Grease-proof paper finds extensive application in food packaging where resistance to the passage of grease is of vital importance. It is also used in the packaging of machinery parts which need protection with a film of oil or grease.

Grease-proof paper is reported to be manufactured by one or two firms in the country using imported pulp, but the production of these two units is insufficient to meet the requirements of the country. Hence, a sizable part of the requirements is met by imports,

involving a considerable amount of foreign exchange. For example, glassine paper amounting to 900 tonnes (value, Rs 35.29 lakh) and grease-proof wrapping paper amounting to 76 tonnes (value, Rs 2.64 lakh) were imported during 1969-70.

The Regional Research Laboratory (RRL), Jorhat, has successfully developed a process for the manufacture of grease-proof and glassine papers starting from an industrial waste material which is at present used as fuel only. Some state governments have even raised objection to the burning of this waste material in boilers. The process developed by RRL, Jorhat, not only overcomes the objection in this regard, but successfully utilizes the industrial waste for the manufacture of paper of this type which is imported.

The process consists in the pulping of the material with certain chemicals, washing the pulp, beating it with or without prior bleaching and sheet-forming to obtain grease-proof paper. The grease-proof paper is converted to glassine paper by means of super-calendering.

Since the product is being imported at the present moment, there would be no difficulty about the marketability of the product.

The main raw materials required for the manufacture of grease-proof paper and glassine paper are : industrial waste material, alkali, chlorine, and sodium peroxide. All are available indigenously.

Cutter, digester, cooking liquor, preparatory equipment, blow pit, beater, bleaching towers, storage tank, paper machine, calender, reeler, and conveyor pumps are the main items of plant and machinery. All the plant and machinery can be fabricated indigenously.

The total capital outlay for a 5 tonnes per day capacity plant has been estimated at Rs 70 lakh (Rs 53.20 lakh as fixed capital and Rs 16.80 lakh as working capital). The cost of production according to RRL process comes to Rs 3155 per tonne against the cif price of Rs 3500 per tonne for the imported material.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Speciality Papers

The know-how for the manufacture of speciality papers like filter papers, drawing papers, document papers, and base paper is a closely guarded secret. Speciality papers find a wide range of uses. Most of these varieties of paper are being imported at present. The prices of imported varieties are given below :

	Rs/ream (approx.)
Filter papers, qualitative	
17×22 in.	500
Drawing paper	
22×30 in.— 72 lb	1000
27×40 in.—135 lb	1800
Cream-toned document paper	
20×28 in.	300

The process developed at the Regional Research Laboratory (RRL), Hyderabad makes use of waste raw materials like tailor cuttings from garment making industry, and cotton linters from ginning industry. These raw materials contain high grade cellulose and can be processed into pulp and paper of several grades using the same equipment. The process can be divided into two stages : (i) pulp preparation, and (ii) paper making.

The details of pulp preparation vary with the product to be manufactured. However, the process is essentially as follows. The raw materials are beaten in Hollander type beaters to the required level of freeness, and washed. The washed stock is beaten to pulp of desired freeness level. The pulp is then engine-sized with rosin soap, sodium silicate and alum. If the pulp is not of required brightness, an optical whitening agent is added prior to engine-sizing.

The process has been studied on a pilot plant of 50 kg batches.

The speciality papers produced at RRL, Hyderabad have been sold to a number of consumers, and have been accepted as good substitute for imported variety by the consumers.

The raw materials required in the process are : new white tailor cuttings, new white hosiery cuttings, cotton liners and some chemicals.

The principal machinery required are : rotary rag cutter, mechanical rag duster, spherical rotary pressure digester, beater with wash drums, refiners, centricleaners, fourdrinier or cylindrical mould machine, press, driers, size press, calender, winders, cutters, and

packing machine.

The total capital outlay for setting up a plant capable of producing 1500 tonnes of speciality papers per annum has been estimated at about Rs 85 lakh.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

CSIR SUPPORT TO RESEARCH

Completed Schemes

Karyological Studies on Indian Gastropod Molluscs

During the past two decades, various animal groups have been thoroughly investigated from cytological, genetic, cytochemical, anatomical, morphological, embryological and taxonomical aspects. However, the molluscs, which are taxonomically next only to insects, have not attracted the attention of cytologists. Consequently very little is known about their chromosomes.

The present CSIR-supported project was undertaken at the suggestion of Prof. G. P. Sharma of the Department of Zoology, Panjab University, Chandigarh, in October 1969 with a view to studying (i) the number of chromosomes and their morphology in as many species of molluscs as possible; (ii) the mitotic and meiotic process in germ cells; (iii) the evolutionary pattern in molluscs on the basis of karyotype evolution; and (iv) polyploidy and sex mechanism in the class Gastropoda. The studies were carried out by Shri J. S. Gidda, a CSIR research fellow, under the direction of Prof. Sharma at the Department of Zoology, Panjab University, Chandigarh.

During the course of the present investigations the chromosome numbers of 37 species belonging to class Gastropoda were determined for the first time. Although the chromosome numbers have been helpful in determining the systematic position of many of the gastropoda, it has been found that the

chromosome numbers are not the absolute and final tool for reliable taxonomical studies. While determining the systematic position, not only the cytological but morphological characters should also be taken into consideration. The present studies reveal that species which are cytologically primitive can be morphologically advanced and *vice versa*.

The chromosome morphology has been discussed in all the 37 species, as is customary, during spermatogonial metaphase, metaphase I and in the metaphase of the second meiotic division. It has been observed that the chromosomes during these stages possess fairly constant shapes and are of standard size at the intra-specific level. The gastropod chromosomes are gene-

rally V-, J-, rod- or dot-shaped at metaphase.

During the mitotic and meiotic cycle no typical character peculiar only to molluscs has been observed. The process of cell division in molluscs is typical and presents little or no departure from the standard descriptions.

The sex chromosome has been identified in four species of the genus *Nerita* and in *Paludomus tanschaurica* due to its heteropycnotic behaviour during the meiotic cycle. Heteropycnotic reversibility has also been observed in *P. tanschaurica*. Polyploid cells have been observed during the spermatogonial metaphase of *Lymnaea auricularia*, *Aplysia benedicti* and *Planorbis* sp.

PATENTS FILED

1207/72 : Improvements in or relating to the electrolytic reduction of nitrobenzene to aniline, H. V. K. Udupa, G. S. Subramanian, P. N. Anantharaman & A. Pourassamy—CECRI, Karaikudi.

1227/72 : Air cushioning in foot wears, R. Nigam & R. S. Kundi—MERADO, Ludhiana (CMERI, Durgapur).

1254/72 : Equipment for mechanized casting of cored units, S.M.K. Chetty, S. S. Wadhwa, P. Sivajee & N.N. Bhise—CBRI, Roorkee.

FORM IV

(See Rule 8)

Statement about ownership and other particulars as required by clause 19-D of the Press and Registration of Books Act.

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| 6. Names and addresses of individuals who own the newspaper and partners or shareholders holding more than one per cent of the total capital | |

I, Y. R. Chadha, hereby declare that the particulars given above are true to the best of my knowledge and belief.

15 March 1973

(Sd) Y. R. Chadha
PUBLISHER



19 APR 1973

Seminar on Bacterial Leaching

Bacterial leaching methods are adopted in a number of countries for the treatment of low grade ore deposits and rejected waste dumps of copper and uranium. In India, some work is being carried out with regard to uranium ores by the Atomic Energy Commission. India's resources of non-ferrous metals are meagre and are essentially low grade. Many pocket deposits, which are not extensive, do not warrant the setting up of conventional mining, grinding, flotation-smelter refining complex. There are some complex deposits containing the sulphides of copper, lead and zinc in such finely interlocked state that they defy physical separation into individual concentrates. There are also big ore deposits where the mineral is very finely disseminated throughout the ore body and can be worked up profitably by open pit mining. This mining method would lead to a large quantity of the mined mineral being rejected as low grade. In such cases bacterial leaching of copper ores comes into play for augmenting copper production without much additional costs.

Natural leaching of such waste heaps of ores not amenable to conventional process has been carried out since long. But only recently the role of the bacteria *ferro-bascillus-thio-oxidans* in solubilizing the metallic values has been understood. The mines from where the sulphide ores are mined out are the natural habitat of these bacteria and they thrive well in them. These bacteria depend on atmospheric carbon dioxide for their cell metabolism and derive their energy from oxidizing elemental sulphur and ferrous iron and

continuously generate sulphuric acid and ferric sulphate useful for leaching out the metallic values from the ores.

Bacteria have been identified to play a role in the following operations :

(i) *Dump leaching* : Circulation of water through waste dumps containing low metallic values (upto 0.4% copper sulphide) oxidizes copper sulphide to copper sulphate, which is recovered as a dilute solution.

(ii) *Heap leaching of ores* : Low grade sulphide ores and oxide ores of copper which are not amenable to conventional processes are made into heaps and water is allowed to percolate in them.

(iii) *In situ leaching of ores* : The portion of the ore left out in the underground mines is washed with water, at times with additional nutrients for bacteria to recover the left out metallic values.

All these three operations would help in augmenting the country's production of copper.

Recent developments in this field indicate that these bacteria can also be made to work in the conventional leaching tanks employing ore concentrates. Solutions containing copper and zinc have been produced containing 40 g/litre of copper and 110 g/litre of zinc respectively; solutions of such strength are suitable for the recovery of metals by electrolysis. If this process can be commercialized, it would go a long way in preventing pollution problems encountered in smelting operations.

In view of these developments in this field, and for the possible augmenta-

tion of the production of copper by the application of this method in this country, an inter-laboratory project on 'Bacterial Leaching' was taken up involving the following laboratories: National Metallurgical Laboratory, Jamshedpur; Central Mining Research Station, Dhanbad; National Chemical Laboratory, Poona; and Regional Research Laboratory, Bhubaneswar.

For proper identification of the problems, a seminar on Bacterial Leaching was held at NML, Jamshedpur on 21-22 December 1972.

The scope of the seminar broadly covered the following aspects :

- (1) Assessment of low grade deposits of non-ferrous metals such as copper, cobalt, nickel, molybdenum and uranium for their suitability for bacterial leaching;
- (2) Bacterial leaching as an alternative process for conventional processes for extraction;
- (3) Economic viability of bacterial leaching of low grade ore as compared to conventional methods;
- (4) Recovery of metallic values from dilute solutions with special reference to copper using cementation, ion exchange and solvent extraction techniques;
- (5) Role of bacteria in the dissolution of minerals; and
- (6) Isolation and identification of bacteria responsible for leaching of ores, etc.

Prof. V. A. Altekar, Director, NML, in welcoming the participants to the seminar, suggested the inclusion in the project of other organizations working in various disciplines, e.g. geology, geochemistry, chemistry, microbiology, hydrology, mining and metallurgy. In view of the coming up of the open pit

mining of copper ore project at Malanjand, he said, great scope exists for the bacterial leaching process.

In three technical sessions twenty papers covering the various facets of the subject were presented. At the end of technical sessions, panel and inter-laboratory group discussions were held. The following recommendations were made:

(1) Basic research will be undertaken by NCL, Bhabha Atomic Research

Centre, Trombay, Atomic Minerals, Delhi and RRL, Bhubaneswar.

(2) Heap leaching and *in situ* leaching studies will be undertaken at NML, CMRS, Atomic Minerals, Delhi, and Uranium Corporation of India Ltd, Jadugoda.

(3) Recovery studies of metals from dilute solutions will be taken up at NML, BARC, Atomic Minerals, Delhi and RRL, Bhubaneswar.

Import Substitution & Invention Awards: Award Winning Processes

(Contd from 15 March 1973 issue)

Wire Resistance Strain Gauges

Designed and developed for the first time in the country by the National Aeronautical Laboratory (NAL), Bangalore, the electrical wire resistance strain gauge is a device used widely in research laboratories and industry for the measurement of basic strains and physical parameters such as pressure, force, acceleration and torque as a function of strain. Measurement of surface mechanical strain is of great importance in the fields of aeronautics, mechanical structures and in the applied field of transducer technology. Electric

cal strain gauges by virtue of their size and amenability to remote monitoring are most suitable for such applications.

A strain gauge of wire type is essentially a length of wire held under tension which when stretched changes its resistance. Four of these are kept in a Wheatstone bridge configuration to enable the measurement of very small changes of voltage. In practice, this length of wire is folded back and forth a few times to decrease the size and the whole arrangement is sandwiched between layers of paper having lead

wires for the convenience of soldering. This assembly when bonded to any surface such that it follows the surface elongations of the host surface faithfully works as a strain gauge.

The bakelite based strain gauges are vastly superior to the paper strain gauges in performance and properties. Being baked in bakelite, the wire inside the gauges is frozen in place thereby improving the hysteresis characteristics of the gauges. These gauges can carry current up to 50 mA and can withstand temperatures up to 150°C without deterioration in their characteristics.

A series of adhesives has been perfected to match the strain gauges for optimum performance in static and dynamic strain transference.

The laboratory has fabricated and supplied to users more than 6000 gauges in various sizes and resistances ranging from 3 to 20 mm in gauge lengths and 60 to 600 ohms respectively. The demand for these gauges has been estimated at one million pieces per year by the Electronics Commission.

The know-how for the production of bakelitized wraparound type electrical



Wire resistance strain gauges developed by the National Aeronautical Laboratory, Bangalore. The laboratory has fabricated and supplied to users more than 6000 gauges in various sizes and resistances ranging from 3 to 20 mm in gauge lengths and 60 to 600 ohms.

resistance strain gauges has been released to two small scale industries for commercial production.

Calcium Tungstate Blue Phosphor

Calcium tungstate blue phosphor finds application mainly in the fluorescent tube light industry. At present there is no indigenous production of this material and the entire requirements are met through imports. Against the present total requirement of 12.5 million tubes per annum, the demand for various coloured phosphors has been estimated at 144 tonnes, of which the present requirements of calcium tungstate blue phosphor powder could be put at 3.75 tonnes per annum, rising to about 6 tonnes by 1973-1974. The demand is likely to increase further with the implementation of the rural electrification programmes and the increasing use of fluorescent tubes in urban areas.

The process developed by the Central Electrochemical Research Institute (CECRI), Karaikudi for calcium tungstate blue phosphor is as follows.

A calcium oxide-containing substance, such as calcium carbonate, and a tungstic oxide-containing substance, such as tungstic acid, both of high purity and in finely divided state, are mixed in the required proportion, air-dried to whiteness at about 110°C, ground, heated at about 1000°C (for a length of time depending on the quantity), quenched in air, ground, and sieved through 300 mesh to give a phosphor, which on excitation with 2537 Å mercury radiation (as in the fluorescent tube light) gives a peak emission fluorescence of blue colour at about 440 nm.

The advantages of the process developed (Indian Pat. 113869) are that: (i) no pre-heating other than air drying is necessary; and (ii) no re-heating at high temperature is done.

Calcium carbonate and tungstic acid are the main raw materials required. Calcium carbonate is available indigenously but tungstic acid will have to be imported.

The various items of plant and machinery required are: ball mill, air oven, high purity silica crucibles or trays, furnace (going up to about 1100°C), weighing machine, water distillation column, ultraviolet lamp giving 2537 Å radiation, luxmeter or photomultiplier, and sieving screen sets. Ultraviolet lamp and luxmeter or photomultiplier are desirable for quality control of emission characteristics on a small scale. All the items of plant and machinery are available indigenously.

The total capital outlay for a plant, assuming 300 working days per annum, to produce 3 tonnes of calcium tungstate blue phosphor has been estimated at Rs 5 lakh. The cost of production works out at about Rs 200 per kg as against Rs 210-280 per kg for the imported phosphor.

The process is available with the National Research Development Corporation of India for exploitation.

Cadmium Sulphide Photocell

This process developed by the Central Electrochemical Research Institute (CECRI), Karaikudi, is an improvement in the preparation of sintered cadmium sulphide photoconductive cells.

Cadmium sulphide photocell converts varying intensities of light into correspondingly varying intensities of electric current by the application of certain voltage to the cell. These cells are either of single crystal or polycrystalline type. Among the polycrystalline ones, the sintered type of cells are most popular because large area cells can be made easily and are very cheap.

The cells find application in a wide range of devices—alarms of various types, control of various dimensions, for example, very fine wire length measuring instrument, safety device for optical product ejection, automatic switching of automobile headlights, general automatic control, exposure meters, colorimeters, pressure gauges, contrast and brightness control for TV receivers, frequency counters, noise-free volume controls, automatic voltage regulators, card punchers, and electronic computers.

The essential elements of a cadmium sulphide photoconductive cell are substrate, sintered cadmium sulphide photoconductive layer, electrodes, protective moisture resistance sealant, and connecting leads soldered to the electrodes.

The know-how developed is an improvement over the existing techniques in that the preparation of the cadmium sulphide powder is achieved by a simple method and the sensitization is obtained by a single firing.

High purity cadmium sulphide powder prepared by CECRI is sensitized by incorporating copper and chloride ions in required proportions and firing with a suitable flux under optimum conditions. The sensitized powder is sintered on a ceramic substrate to obtain an adherent photosensitive layer of cadmium sulphide.

The cells prepared by CECRI are sensitive to the visible region of the spectrum with a peak response at 0.62μ. The cells are entirely indigenous and the cost of production is Rs 3.50 per cell. The cells possess high light to dark ratio of conductivity of about 10⁴.

At present the entire requirements are met through imports. The estimated annual demand for these cells is about 30 000.

CSIR Silver Jubilee Awards

Three scientists, namely Prof. P. K. Bhattacharyya, of the Department of Organic Chemistry, Indian Institute of Science, Bangalore; Prof. S. Chandrasekhar of the Raman Research Institute, Bangalore, and Dr S. K. Joshi of the Physics Department, Roorkee University, Roorkee, have been selected for the CSIR Silver Jubilee Awards.

This CSIR award has been instituted to provide an opportunity to exceptionally talented Indian scientists and engineers for conducting research in their chosen fields and projects. The awardees have every freedom to conduct research without administrative or financial restrictions. They can utilize the grant as they deem fit in matters

relating to appointment, purchase of equipment, chemicals, etc.

The awards are made by a committee of eminent persons in different branches of science and engineering and carry a grant of up to Rs 1.5 lakh per annum to an individual for a period of three to five years depending upon the nature of research to be undertaken.

The other two recipients of the awards, which were recommended last year, were Dr K. A. V. Pandalai, Professor and Head of Aeronautical Engineering, Indian Institute of Technology, Madras, and Dr N. K. Bhide, Associate Professor, Department of Pharmacology, All India Institute of Medical Sciences, New Delhi.

A brief account of the contributions of Dr S.K. Joshi as well as of the scope of the proposed research project to be taken up by him follows.

Dr S. K. Joshi's contributions

Dr Joshi's contributions range over a wide variety of topics in solid state physics and atomic and molecular collisions. His main research interests presently are the theory of electronic states in disordered state of condensed matter, the theory of electron correlation in narrow band solids and concomitant studies of magnetic behaviour and Mott transition and the theory of phonons in metals.

Dr Joshi has proposed a number of models for the study of electrons in disordered alloys. These models have been used by his group to study electronic states in a number of binary alloys. These studies have been correlated with experimental investigations using the optical and the photoemission methods. Dr Joshi has also contributed to the study of the electron correlation in narrow energy bands of transition and rare earth metals, their compounds and alloys. The Hubbard model, which is a gross oversimplification for real solids, has been generalized to incorporate interatomic Coulomb and *s-d* interactions. The findings have led to a better understanding of the conditions for the existence of ferromagnetism and the metal-nonmetal transition in these materials.

Dr Joshi has been working on lattice vibrations in solids for a long time and has substantially contributed to a better understanding of the interatomic forces. An attempt has recently been made to understand the problem of lattice vibrations in transition metals from a microscopic point of view. Dr Joshi has also contributed a review article on phonons in metals in *Solid State Physics* series. He has successfully studied the problems of vibrations of normal metals and ionic crystals both from phenomenological and microscopic points of view. He has made a careful analysis of the role of phonons in thermal conductivity of insulators, in electrical and thermal resistivity of metals, in scattering of electromagnetic radiation, in thermal expansion and in the nuclear quadrupole relaxation phenomena. He was awarded the Watumull memorial prize in 1965 for his contributions to the study of lattice dynamics of solids.

Dr Joshi has also studied the excitation and ionization process in atoms, ions and molecules due to the impact of charged projectiles like electrons and protons. These studies could be of importance in plasma confinement, in astrophysical problems and in the study of upper atmosphere.

Dr Joshi was selected U.G.C. National Fellow in 1972 and is an Associate of the International Centre for Theoretical Physics Trieste. He has published 110 research papers.

Scope of Dr Joshi's Research Project

Electronic structure of disordered condensed matter is one of the principal questions with which many research groups are grappling. The project which Dr Joshi proposes to investigate will lay emphasis on the study of the following topics in the physics of the disordered systems.

Disordered alloys: The theory of electronic structure of disordered alloys is still in a stage of explosive growth. It is proposed to study the alloys of noble metals with noble metals, noble metals with polyvalent metals, noble metals with transition metals, and transition metals with transition metals. These

studies will include a large number of technologically important alloys.

The thermodynamic, optical and electrical properties of these alloys will also be studied. The order-disorder and charge-transfer effects will also be investigated.

A better understanding of the behaviour of electrons in these alloys promises to play a prominent role in materials technology in the future. This may ultimately lead to a tailoring of materials of desired physical properties. Pure metals may not have the requisite qualities for practical use. One can prepare innumerable alloys by not only varying the composition but also by many complex thermal treatments.

Amorphous and glassy materials: In amorphous and glassy materials the nearest neighbours show nearly the same spatial arrangement as in the corresponding perfect crystal but the farther neighbours are arranged in quite a disordered manner. There exists an extremely wide variety of such materials and one can scarcely envisage an end to the investigation of the properties of such complex and diverse systems. Here the conventional concepts about the nature of electrons in pure crystals break down and the amorphous materials and complex glassy compounds present a paradox for solid state theory. The theory is still in its infancy. Here most of the theoretical work is uncertain and controversial and hence a concerted effort to understand the fundamentals in order to arrive at a quantitative theory is of utmost importance.

In order to understand the peculiar electrical and other transport properties one has to answer the questions: Can an electron be localized by disorder and how much disorder is needed to immobilize the electron? The object of this project is to gain insight into some of parameters of the problems of electrical conductivity and optical properties in these disordered systems from first principles. Recently, considerable interest in amorphous semiconductors has been stimulated by

the observation of fast electrical switching in thin films. The potential which amorphous semiconductors have for new switching and memory devices and other applications is currently engaging the attention of research workers in this field all over the world.

Polymerized materials : It is also proposed to study the statistical mechanics of polymer systems. Because of almost free rotation about bonds in a polymer, a single long polymer chain can have an enormous number of different conformations. The difficulty of a description of a single polymer chain arises from a very large number of degrees of freedom possessed by a polymer molecule. The thermodynamic, electrical and optical properties of polymers will be evaluated by statistical physics. The problem of the description of the observable properties

corresponding to bulk polymers appears to be unsurmountable. Some simple models will be constructed to simulate the real system.

Defects and physical properties : In addition to the study of disordered materials the project will include a study of property changes of perfect crystalline materials due to the introduction of various kinds of defects. The studies will embrace : influence of point defects (which are vacancies and interstitials); line defects (which are dislocations with or without anchoring), surface defects including arrays of dislocations acting in unison and thin microcracks; and volume defects in which class come displacement spikes and rounded cavities. The influence of such defects on mechanical and electrical properties, diffusion, local ordering, creep and brittleness will be analyzed in terms of suitable models.

industry, (v) development of special fuels to substitute imported fuel (charcoal) for detonator fuse, and (vi) tackling erosion and corrosion problems of the thermal power station of DVC at Chandrapura. The revenue earned during the year from the sponsored projects amounted to Rs 2.95 lakh, besides a sum of about Rs 3.02 lakh received for analyses and testing.

Some of the notable achievements during the year relate to investigations to locate new coking coal resources in Jharia and East Bokaro coalfields. Earlier, VIII seam of Jharia coalfield was found to contain prime coking coal in the eastern zone. Similarly, the overlying VIIIA seam coal in the Sudamdih area of Jharia coalfield is found to be parent coking coal. Two thick seams, having high caking index, have been encountered in the Barren Measure Zone of Jharia coalfield. The coals contain 15-18% ash and low volatile matter (below 22%). In the Jarangdih block of East Bokaro coalfields, seams have been found to contain prime coking coals.

A major resources development plan for the utilization of Singrauli coal has been prepared which envisages annual utilization of 22 million tonnes of the sub-bituminous coal to produce energy fuels (electricity, gas, washed coal, etc.), fuels for the metallurgical industry and for the domestic sector, besides the setting up of metallurgical, chemical and fertilizer industries. A survey of quality resources and production potential of coal in Darjeeling coalfield has been prepared at the request of the Government of Bhutan.

A new technique for obtaining ultra-clean coal for use in chemical and metallurgical industries has been developed.

A process for making spherical sized smokeless domestic fuel from coking coal washery middlings and rejects and high ash caking coals has been prepared. This has considerable potential for effective utilization of large amounts of these waste materials.

A process has been developed for producing hard composite quartzite-

PROGRESS REPORTS

CFRI Annual Report : 1970-71

The major areas of work of the Central Fuel Research Institute (CFRI), Dhanbad during 1970-71 related to: (i) commercialization of processes developed, (ii) consultancy services on resources utilization, and (iii) solution of operational problems in working plants, besides development of processes for utilization of coal and byproducts of coal-based industries. The annual report of CFRI for 1970-71, which has been published recently, shows that contracts were signed for the commercial exploitation of the processes relating to : (i) 3- and 4-cyanopyridines, (ii) anthraquinone from anthracene, (iii) benzaldehyde from toluene, (iv) benzoic acid from toluene, and (v) oleoflotation (technique for simultaneous dewatering and upgrading of coal fines) with leading consulting firms of India and some Indian counterparts of international firms. A process for selective preparation of coal by pneumatic separation has been developed on up to 5 tonnes/hr scale and its further development and commercialization were

under negotiation with a coal preparation firm.

The institute has undertaken an important project on behalf of the Gujarat Mineral Development Corporation on the preparation of a feasibility report for the utilization of Gujarat lignite. Some of the sponsored projects were concerned with: (i) utilization of Borachak seam coals, (ii) utilization of the residues of the Gujarat Petroleum Refineries, (iii) selection of coal for the sponge iron plant in southern India, (iv) availability of coals for DVC super-thermal power station at Maithon, and (v) projecting of hard coke requirements for foundries and allied industries for the decade 1970-80. Other industry-sponsored work included : (i) development of coal blend for the Bhilai Steel Plant, (ii) study of performance efficiency of Kargali Washery of NCDC, (iii) improving operational efficiency of Bararee Coke Ovens and working of beehive coke ovens (one each in Assam, Jharia and Raniganj coalfields), (iv) preparation of anode and cathode blocks for aluminium

incorporated briquettes from coke breeze, lignite char, etc. having high electrical resistivity and strength. These constitute improved charge for ferro-silicon manufacture. A process has been developed for the production of hard, smokeless, weather-resistant, free-burning, shaped fuels from coke breeze using a low percentage of binder. This is of considerable significance as coke breeze, which is obtained to the extent of 6-8% of the coke produced in high temperature carbonization industry, has limited use due to its size and low-ignition characteristics.

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

Active Carbon from Rice Husk

Active carbon obtained from rice husk is of low ash content, having high adsorption capacity. Such a carbon is particularly suitable for pharmaceutical industry. The market price of this type of carbon is in the range of Rs 4000-5000 per tonne.

A part of the active carbon requirement of the pharmaceutical industry is still being imported. To obviate the import of this grade of active carbons, the Regional Research Laboratory (RRL), Hyderabad, has developed a process for their manufacture using locally available rice husk as the starting material. Large quantities of rice husk are available in the country which are not at present being put to any industrial use. Besides solving the problem of utilization of an agricultural waste, the process gives a valuable by-product, viz. sodium silicate.

The process consists in screening the rice husk to remove extraneous matter and subjecting the screened material to carbonization and steam activation at elevated temperatures in a rotary kiln. The activated material discharged from the kiln is collected in treatment tanks for the removal of silica. Washed, active carbon is dried, sized and packed. The product obtained was found acceptable to consumers.

The raw materials required are rice husk and caustic soda, both of which are available in the country.

Another major item of work of the institute during the year is the preparation of a techno-economic feasibility study for the conversion of Assam coal into chemicals and oil with emphasis on chemicals as end products. In this project, annually 2.5 million tonnes of Upper Assam coal are expected to be hydrogenated to produce two-thirds of its end products as chemicals and one-third as middle distillates.

Forty-two research papers were published and seven patent applications were filed.

The plant and machinery required are: rotary kiln, rotary filter, vacuum pump, tray drier, ball mill, mixing tank, slurry pump, boiler, conveyor, waste heat recovery unit, and open pan evaporator. All these are available indigenously.

The total investment required for a plant having a capacity of 2 tonnes of active carbon per day (3 shifts), as estimated by RRL, Hyderabad, is Rs 22.00 lakh (comprising Rs 1.80 lakh on land and building, Rs 14.65 lakh on plant and machinery, and Rs 5.55 lakh as working capital). The cost of production is estimated at Rs 2754 per tonne.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Active Carbon from Coconut Shell

Active carbons obtained from coconut shell are of gas adsorbent grade. These carbons are used in gas masks, in fertilizer and rayon industries and for the recovery of solvents.

At present good quality gas adsorbent carbons are not being made in the country and their requirement is being met by imports. The present annual requirement of gas adsorption grade carbons is estimated at 300 tonnes. The market price of these carbons

is in the range of Rs 10 000-12 000 per tonne.

In order to obviate the imports of gas adsorbent carbons, the Regional Research Laboratory (RRL), Hyderabad has developed a process using coconut shells, an abundantly available raw material. The process consists of crushing the coconut shell to the required size, treating with zinc chloride and activating in a rotary kiln. The activated material is washed, pelletized, dried and packed. The product obtained conforms to the specifications of commercial grade active carbons used for similar applications.

The raw materials required are coconut shell, zinc chloride, hydrochloric acid and binder. All these are available indigenously.

The main items of equipment required are: jaw crusher, disintegrator, digestion vessel, rotary kiln, filter, drier, rotary mixer, tableting machine, and boiler. All these are available indigenously.

For setting up a plant of one tonne of active carbon per day (3 shifts) capacity the total investment, as estimated by the laboratory, is Rs 20.37 lakh (comprising Rs 2.30 lakh on land and building, Rs 14.47 lakh on plant and machinery, and Rs 3.60 lakh as working capital). The estimated cost of production is Rs 7616 per tonne.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Cellulose Powder

Cellulose powder is used in chromatographic work for the separation of rare earths, of radio active materials and of various organic compounds. It can also find other applications such as coating material for electrodes, filter medium and/or as filter aids. The exact requirements of cellulose powder in the country for various applications are not available. There is no production of chromatographic grade cellulose powder in the country and, therefore, it is presumed that the entire requirement is met through imports.

The National Chemical Laboratory (NCL), Poona, has successfully developed a process for the manufacture of cellulose powder starting from rayon grade pulp or cotton linters. The pulp is hydrolyzed with a dilute acid, and the residue obtained is filtered, washed, dried and converted to a fine powder (300 mesh). The work in the laboratory has been conducted on 1 kg per batch scale. The cellulose powder prepared by NCL has been found useful in chromatographic separation of several organic compounds. It compares well with the imported material.

Rayon grade pulp, sulphuric acid and ammonia are the principal raw materials required for the manufacture of cellulose powder.

Lead-lined reactor with stirrer and motor, washing vessel, centrifuge, drier, grinder, centrifugal pump and boiler are the major items of plant and machinery. All are indigenously available, or can be fabricated in the country.

The optimum capacity of an industrial unit is assumed as 30 tonnes per annum. The capital outlay for a plant of this capacity has been estimated at Rs 2.10 lakh (Rs 1.50 lakh for land, building and plant, and Rs 60 000 as working capital). The cost of production of the product (naked) according to the process comes to Rs 5.15 per kg.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Dr Harsh Vardhan

Dr Harsh Vardhan, Senior Professor, Instrument Design Development Centre, Indian Institute of Technology, New Delhi, has been appointed Director, Central Scientific Instruments Organization, Chandigarh with effect from 2 February 1973.

Dr Harsh Vardhan (born 12 April 1923) took his B.Sc. (Hons. School) and M.Sc. degrees in physics from the



Panjab University. Taking up a CSIR research fellowship under Prof. P. K. Kichlu, he designed and fabricated machines for cutting, grinding and polishing diamonds. He made several diamond tools and worked on other semi-precious stones. His work on the determination of crystallographic axes of diamond using back reflection X-ray patterns was well reviewed by the scientific community.

In 1950 he joined the Defence Science Organization, where he worked on defence problems in the fields of applied and industrial physics. Proceeding to USA in 1953 for higher studies, he obtained a doctorate in engineering physics from the Cornell University, and this gave him a firm foundation in modern physics, machine shop technology and industrial electronics. On his return to the Defence Science Laboratory Dr Harsh Vardhan headed the Instrumentation Group in the Division of Applied Physics. He was responsible for the design and development of a number of instruments for defence research. He also undertook the development of a high speed photographic equipment and the setting up of the country's first shock tube, both being of importance in defence research. The high speed camera designed and fabricated by him won him the highest award from the Inventions Promotion Board in 1966.

The technique of making replica diffraction gratings, developed in the country for the first time, and later extended to commercial production, owes much to the efforts of Dr Harsh Vardhan. In 1963 his services were availed of by the Solid State Physics Laboratory while it was being established.

The development of a method for the purification of silicon to transistor grade purity and setting up of a pilot plant for its production are also due to his efforts. Dr Harsh Vardhan established the techniques of photolithography and mask making for thin film integrated circuits. Several thin film circuits, including those for an audio-amplifier, a radio receiver (the size of

a cigarette carton), multivibrator and oscillator, were made.

Dr Harsh Vardhan has been responsible for equipping a special laboratory for SIC work and creating clean room facilities. Techniques of masking, opening of windows, diffusion, coating and attaching the leads, etc. to desired dimensional specifications were established by his team. Several solid state devices were developed and supplied to the users. Interstitial images and complicated dial scales were produced for the first time in the country. Techniques of manufacturing button type sealed nickel-cadmium cells, cadmium sulphide photo-conductors, etc. were developed.

In 1970 he was appointed Senior Professor at the Indian Institute of Technology, Delhi to head and establish an Instrument Design Development Centre with the objective of designing and developing sophisticated instruments for teaching, research and industry.

Dr Harsh Vardhan is a member of the Institute of Telecommunication Engineers and has 27 publications to his credit.

LORANTHACEAE

The eighth in the series of botanical monographs published by the Publications & Information Directorate of CSIR, Loranthaceae is one of the well known families of angiosperms which includes semiparasitic plants, popularly known as mistletoes. Because of their unusual habit, characteristic wood flowers, and interesting embryology, the mistletoes have, since long, attracted much attention. In the present monograph the authors (Prof. B. M. Johri and Dr S. P. Bhatnagar, Department of Botany, University of Delhi) have attempted to consolidate the scattered literature on the family.

The morphological nature of the calyculus, and of the haustorium, has been discussed in detail. It has now been proved, beyond doubt, that the calyculus represents a true calyx and haustorium is stem-like. The unique features of the family, such as the absence of true ovules, elongation of

embryo sacs to various heights in the style and stigma, and a 'composite' endosperm, have been dealt with at great length. In addition, systematics, distribution, haustorial system and cytology have been discussed.

According to most of the taxonomists Loranaceae consist of two sub-families: Lorantheae and Viscaceae. Recent investigations on the embryology of these sub-families clearly indicates that they are very different, and each deserves the status of an independent family. The affinities of these families have been discussed in the chapters on classification and inter-relationships.

The 142-page (royal 8vo) monograph is profusely illustrated and contains an exhaustive bibliography, and would be useful to teachers, research workers and students.

Copies of the publication, price Rs 32 (\$ 11.00/£ 3.20), can be obtained from: Sales & Distribution Officer, Publications & Information Directorate (CSIR), Hillside Road, New Delhi 110012.

INDIAN SARDINES

This is the second in the series of zoological monographs published by the Publications & Information Directorate of CSIR.

Indian sardines are regarded as fishes of great economic importance, and constitute a good proportion of marine fish production from Indian waters. Of the nine species of sardines occurring in India, the oil sardine (*Sardinella longiceps*) occurs abundantly along the west coast and has great value as food and manure.

The monograph has been compiled by Dr R. V. Nair of the Central Marine Fisheries Research Institute, Mandapam Camp (Tamil Nadu), who has studied for over two decades the different aspects of the biology and fisheries of oil sardine and lesser sardines, and has coordinated various research projects on sardines. The monograph highlights the achievements made on the above aspects in India to

facilitate further planning of research in this field.

The monograph (8vo, 90 pages) is well illustrated, contains an exhaustive bibliography, and would be useful to students, research workers and pisciculturists.

Copies of the publication [price Rs 22 or \$ 7.00/£ 2.20] can be had from: Sales & Distribution Officer, Publications & Information Directorate (CSIR), Hillside Road, New Delhi 110012.

Termite Problems in India

The proceeding of the symposium on Termite Problems in India, held under the auspices of the Biological Research Committee of CSIR in New Delhi on 26 and 27 March 1970, have been published recently. The volume (royal 8vo, 72 pages) contains, besides opening remarks by Dr M. L. Roonwal (chairman, Biological Research Committee), fourteen papers dealing with: destruction of ordnance stores by termites; role of termites in forestry; laboratory testing of natural termites resistance of Indian woods; termites in agriculture and losses caused by them; problems of taxonomy in termites; termites and their control in buildings; termite problems in tropical ecology; importance of cytogenetical work on termites, and the role of universities; termites problems in jute and allied fibre crops; problems of termites in sugarcane; problems of termite control; termite pests of fruit trees and grasses; protozoa in Indian termites and their role in wood digestion; and physiology of digestion in termites. Floor discussions on some of the papers presented and the recommendations made at the symposium are also included.

Copies of the publication (price Rs 9) are available with: Sales & Distribution Officer, Publications & Information Directorate (CSIR), Hillside Road, New Delhi 110012.

Fourteenth Seminar on Electrochemistry

The fourteenth seminar on Electrochemistry will be held from 21 to 24 November 1973 at the Central Electro-

chemical Research Institute (CECRI), Karaikudi.

Original and review papers on any branch of electrochemistry under the following seven sections may be submitted for presentation at the seminar: (1) Electro-deposition and metal finishing; (2) Batteries; (3) Electro-organic and electro-inorganic products; (4) Electrothermics and electro-metallurgy; (5) Electrode kinetics, electrochemical equilibria and electroanalyses; (6) Corrosion; and (7) Solid state electrochemistry.

Last date for the submission of abstracts and full papers: 15 July 1973. Further information may be obtained from: The Director, Central Electrochemical Research Institute, Karaikudi 623003.

CSIR Society

A meeting of the Society of the Council of Scientific & Industrial Research is being held on 30 March 1973 at 4.00 p.m. in Room No. 9, Parliament House, New Delhi.

PATENTS FILED

1265/72: A process for the production of ichthammol from crude oil fraction, S.K. Chhibber, B.R. Chadha, V. P. Malik, K. S. Anand & Prem Krishna Goel—IIP, Dehra Dun.

1314/72: A disc turning attachment, G. Doraiswamy & D.K. Pramanik—CMERI, Durgapur.

1264/72: A process for production of light-weight aggregates for use in civil engineering construction, B. C. Jana, M.K.C. Nambiar, A.C. Khazanchi & M.S. Iyengar—RRL, Jorhat.

1266/72: Improvements in or relating to zinc-lead dioxide batteries, P. B. Mathur, P.N.N. Namboodiri & R. Balasubramanian—CECRI, Karaikudi.

1292/72: Improvements in or relating to the electrodeposition of bright zinc from acid baths, B.A. Shenoi, Mrs M. Pushpavanam & H. V. K. Udupa—CECRI, Karaikudi.

1315/72: Improvements in or relating to electrolytes for etching of aluminium and its alloys for direct plating of metals, B.A. Shenoi—CECRI, Karaikudi.



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Fourteenth Textile Technology Conference : ATIRA, BTRA & SITRA

The fourteenth Technological Conference, sponsored jointly by the Ahmedabad Textile Industry's Research Association (ATIRA), Ahmedabad, the Bombay Textile Research Association (BTRA), Bombay and the South India Textile Research Association (SITRA), Coimbatore, was held at SITRA, Coimbatore on 28-29 January 1973. Twenty-six papers dealing with the various branches of textile technology, textile physics and textile chemistry were presented. A brief summary of some of the important papers follows.

Mechanical Processing

The effect of draft distribution at the draw frame upon sliver irregularity was examined by N. Balasubramanian and V. K. Bhatnagar of BTRA. Various break drafts were tried on different drafting systems. Irregularities introduced at the draw frame have only a marginal effect on the lea strength but have a marked effect on the medium term variation in the yarn and fabric appearance.

The new 'two-for-one' twisting machine developed at SITRA was described by S. Govindarajan in his paper. This paper also dealt with the properties of the doubled yarn in comparison with those of the conventional doubled yarn and also of the cost aspects. Another new method of spinning, the low twist spinning, was the theme of the paper by B. V. Iyer *et al.* of ATIRA. In this method, the roving is wetted thoroughly in water prior to drafting and twisting on a conventional ring frame. The main practical advantage is the increase in production and the major problems

faced are short traveller life and roller lapping.

The influence of processing parameters, combing, and mechanical and other conditions on the incidence of thick and thin places in yarn was the subject of a paper presented by K. Govindarajulu of SITRA. Also, a quick method of estimating the neps in yarn by a template was reported. Another paper from SITRA, by K. S. Shankaranarayana and S. Nandakumar, compared two different methods of blending synthetic fibres with cotton. The main areas of comparison were the blending homogeneity at different stages of processing and yarn property and dyeing uniformity of yarn.

An attempt has been made by K. Ganesh and T. A. Subramaniam of ATIRA to bring out the dependence of lea strength variation on count variation and other factors by analyzing the data from yarn quality survey as well as from specially designed experiments. Attempts have been made to isolate the contribution of count variation to strength variation.

Three papers presented were concerned with the properties of open-end spun yarns. Two papers, one by K.P.R. Pillay of SITRA and the other by Kamal Chandravadan of Vikram Mills, Ahmedabad, dealt with the orientation and migration of fibres in the open-end yarns. The reasons for the weakness of the open-end yarns compared to ring-spun yarns were given. The effect of rotor diameter, yarn tail rotational direction, and of the number of reversals between card and spinning on yarn structure was

also studied by Kamal Chandravadan. The third paper by D. B. Ajgaonkar of Victoria Jubilee Technical Institute, Bombay dealt with the effect of twist of open-end spun yarns on the physical properties of weft knitted single jersey structure.

Textile Physics

G. V. Sarma and R. C. Gupta of Shri Ram Institute for Industrial Research, Delhi presented two papers on the advantages of built-in lubrication (BIL)-treated cotton fabrics. It has been found that BIL-treated shirts show 24% increase in wear life, chiefly in regard to edge wear at collars and fillingwise tearing. Gupta reported the results of a study aimed at obtaining better durable press materials having improved balance of wrinkle recovery and strength properties on fabrics pretreated with BIL finish.

A method of classifying cottons in terms of maturity by X-ray diffraction technique was presented by A. K. Kulshreshtha, V. P. Chudasama and N. E. Dweltz of ATIRA. These workers showed that the degree of conversion to cellulose II for various cottons in a given concentration of sodium hydroxide in a certain range is inversely related to the maturity of the cotton.

An interferometric method for the measurement of lateral compression of fibres was reported in one of the papers. Two identical fibres are sandwiched between a pair of optical flats arranged to produce Edser-Butler fringes in a constant deviation spectrograph. The fibre thickness is calculated, and from the data, the Young's modulus for lateral compression.

A simple method of measuring the crease recovery angles of fibres and

yarns was described by ATIRA workers. A relationship has been worked out between the bound formaldehyde (expressed as percentage) and the corresponding increase in dry crease recovery or loss in tensile strength.

The design and evaluation of ATIRA reed evaluator was presented by M.C. Paliwal and coworkers. Photographic standards obtained with the help of this reed evaluator for the purpose of grading the reeds were presented.

Symposium on Environmental Pollution

A three-day symposium on Environmental Pollution was organized jointly by the Indian Association for Water Pollution Control and the Central Public Health Engineering Research Institute at CPHERI, Nagpur from 17 to 19 January 1973. The main objectives of the symposium were: (i) to work out ways and means for economically solving the problems of environmental pollution control with indigenous know-how and resources; and (ii) to suggest lines whereby pollution abatement procedures could be expeditiously implemented in a self-sustaining and self-generating manner.

In his inaugural address Prof. B. R. Seshachar, of the Indian National Science Academy, stressed that ameliorating the environmental pollution in a few urban areas alone was of no consequence: a meaningful programme must rather engulf 450 million people living in 6 lakh villages. He pointed out that solutions should be devised in the context of the economic, social and physical conditions of our people.

Dr T. R. Bhaskaran, Chief Technologist, Geo-Miller & Co. (Pvt.) Ltd, New Delhi, and President, Indian Association for Water Pollution Control, who also addressed the inaugural session, stressed the need for: adequate research to work out economic and simple methods of waste disposal; proper legislation along with comprehensive powers for the enforcing agencies; and administrative and technical machinery at the national and state levels for effective implementation of legal and other measures to check pollution.

The technical sessions of the symposium were devoted to: (i) Water pollution, (ii) Industrial waste treatment, (iii) Sewage treatment, (iv) Water

quality, (v) Water treatment, (vi) Solid wastes, (vii) Air pollution, and (viii) Environmental pollution.

In all, 44 papers were discussed at the symposium in which 200 delegates participated. Besides these papers, ten state-of-art papers were discussed in three sessions convened by the Indian Association for Water Pollution Control, which celebrated its tenth anniversary. The papers covered a wide range of topics, viz. principles and application of coagulation; development of granular filters; rural water supply; removal of pathogenic micro-organisms from sewage; design and operation of low-cost waste treatment systems; estuarine pollution and effects on fisheries; eutrophication; ground water pollution; economical methods of industrial wastes treatment and cost economics; virus removal during water and sewage treatment; water filtration; refuse characteristics; ground water pollution by solid wastes; sanitary landfill; solid waste disposal in field areas; air quality monitoring; air pollution by various industries; prevalence of diseases due to water pollution as well as sewage farming practices; sterilization of water in the field; pollution control; and environment and economics.

The discussions emphasized that provision of safe drinking water, proper sanitation and clean environment in the rural areas be given top priority. The concluding session emphasized the need for creating awareness among the masses of the problems of environmental pollution by imparting necessary education right from the primary schools. The delegates also expressed deep concern over administrative, economic as well as technological

hurdles which have to be overcome for raising the living standards in general and of rural areas in particular. The necessity of providing stringent measures in the proposed Water Pollution Prevention Bill was also stressed.

A six-member committee was also formed, which will convey to the Government the views of scientists on environmental pollution control.

Republic Day Honours

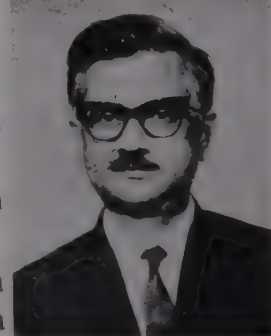
Dr R. Ramanna, Director, Bhabha Atomic Research Centre, Trombay (member, editorial board of *Indian Journal of Pure and Applied Physics* published by CSIR) is among the recipients of Padma Bhushan for the year 1973. Dr M. G. Krishna, Director, Indian Institute of Petroleum, Dehra Dun and Dr N. K. Panikkar, Director, National Institute of Oceanography, Goa are among Padma Shri awardees. Brief biodata of the awardees and their contributions to science and technology follow.

Dr R. Ramanna

Dr Raja Ramanna (born 28 Jan. 1925; Mysore) received his early education in Bangalore. After obtaining his B.Sc. (Hons.) degree in 1945 from Madras Christian College, he proceeded to UK for higher studies and took his Ph.D. degree from London University in 1948.

Returning to India in '49 Dr Ramanna joined the Tata Institute of Fundamental Research where he continues to hold the post of Professor. Transferred to the erstwhile Atomic Energy Establishment (now Bhabha Atomic Research Centre), Trombay, in 1953 as Head of the Nuclear Physics Division, Dr Ramanna became the Director of the Physics Group in 1962. He was appointed Director, Bhabha Atomic Research Centre and Member for Research and Development, Atomic Energy Commission, in 1972.

Dr Ramanna was associated in the design of India's first reactor, Apsara,



and was in charge of the utilization of the research reactors Apsara, Cirus, 5.5 MeV Van de Graaff accelerator and the fast reactor, Purnima, at Trombay.

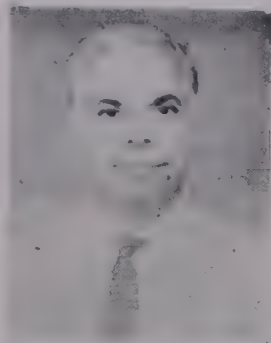
Dr Ramanna has made valuable contributions in neutron thermalization, reactor design, experimental and theoretical studies on low energy nuclear reactions with special reference to nuclear fission. His recent contributions include a new theory of fission process and another important work on a geometric theory of nuclear structure. He was in overall charge of active groups working on the inelastic scattering of neutrons for the study of the condensed state of matter, and recording and interpretation of seismic events including the underground and atmospheric nuclear explosions using a 20-element seismic array and microbarographs.

Dr Ramanna has participated at many international conferences including the four U.N. conferences on the Peaceful Uses of Atomic Energy held in Geneva. He was the chairman of the NORA Committee for a joint project between the Norwegian Government and the International Atomic Energy Agency for the planning and programming of the zero energy reactor in Norway from its inception in 1960. He was also the chairman of the India-Philippines Agency project committee for the utilization of the research reactor at Manila for the study of solid state physics. He was the president of the Physics Section of the golden jubilee session of the Indian Science Congress held in 1963. He is the chairman of (i) Variable Energy Cyclotron Committee to set up a cyclotron at Calcutta, and (ii) Planning & Implementation Committee of the Reactor Research Centre at Kalpakkam, for planning and implementing a fast reactor programme for India. He is also a member of the National Committee on Science & Technology, Executive Council of the Jawaharlal Nehru University, and the recently set up Indo-Soviet Joint Commission. A fellow of the Indian Academy of Sciences and of the Indian National Science Academy. Dr Ramanna was awarded the Shanti Swarup Bhatnagar

Memorial Award for Physical Sciences in 1963. He is also recipient of Padma Shri (1968).

Dr N. K. Panikkar

Dr N.K. Panikkar (born 17 May 1913; Kottayam, Kerala) was educated in Madras. After taking his D.Sc. degree in marine biology from the Madras University in 1938, he proceeded to UK for higher studies at the Universities of London and Cambridge and the Marine Biological Laboratory, Plymouth for specialized research in marine biology and oceanography.



Returning to India in 1943 Dr Panikkar was appointed Professor & Head, Department of Zoology, University of Travancore (now Kerala University). He has held various positions: Director, University Zoological Laboratories, Madras (1944-46); Officer on Special Duty, Ministry of Agriculture, for organizing fisheries research; Director, Central Marine Fisheries Research Institute, Mandapam (1950-57); Fisheries Development Adviser to the Government of India, Ministry of Food & Agriculture (1957-62); and Director, Indian Programme of the International Indian Ocean Expedition (1962-65). He took over as Director, National Institute of Oceanography in 1966.

Dr Panikkar has represented India at various international conferences on fisheries, oceanography, maritime law and international cooperation in sciences. Special mention may be

made of his work as chairman of the Indo-Pacific Fisheries Council (1954-57); as India's representative on the Intergovernmental Oceanographic Commission for several years, including as chairman of the Commission from 1963 to 1965. In international research and development he has played an important part in the Indo-Norwegian Project in India and the UNDP-supported Central Institute of Fisheries Education, Bombay. He is currently part-time member of National Commission on Agriculture and National Committee on Human Environment. His special field of work in these bodies is marine fisheries and marine pollution. He was also President, Indian Geophysical Union (1971-72); Vice President, Indian Academy of Sciences; and Chairman, Indian National Committee on Oceanic Research.

Dr Panikkar is a Fellow of the Indian Academy of Sciences, Zoological Society of India, Royal Society of Arts, London, National Academy of Sciences, Indian National Science Academy, and Indian Geophysical Union.

Dr Panikkar's contributions to the development of Indian marine fisheries and oceanography are widely recognized. As director of the Indian Programme of the International Indian Ocean Expedition, he was largely responsible for developing not only India's programmes but for providing facilities to the participating countries.

Dr Panikkar has published a large number of papers in the fields of marine zoology, fisheries, oceanography, comparative physiology and related disciplines. With Unesco assistance he has edited and published a series of atlases on Indian Ocean plankton.

Import Substitution & Invention Awards : Award Winning Processes

(Contd from 30 March 1973 issue)

Preparation of Anhydrous Potassium Cryolite

The invention relates to the process developed by the Central Electrochemical Research Institute (CECRI),

Karaikudi, for the preparation of anhydrous potassium cryolite. Anhydrous potassium cryolite is used as a moderator in certain types of propellants used in military operations. The

estimated annual demand for this chemical is about 12 tonnes.

A salient feature of the process is the utilization of hydrofluosilicic acid byproduct from superphosphate and phosphatic fertilizer industries to the maximum extent possible in the production of anhydrous potassium cryolite thereby eliminating to that extent the use of the more expensive anhydrous pure hydrofluoric acid. The process involves two stages. In the first stage, hydrofluosilicic acid is utilized for the production of potassium pentafluoroaluminate through the intermediate production of pure dilute ammonium fluoride solution. In the second stage, potassium pentafluoroaluminate is fortified with suitable amounts of potassium and fluorine to obtain the desired potassium cryolite conforming to the stringent specifications laid down by the Defence.

An alternative procedure for the preparation of potassium pentafluoroaluminate was also worked out to suit those manufacturers who have no facility to get byproduct hydrofluosilicic acid. This consists in using pure dilute hydrofluoric acid which is reacted with potassium aluminate to get the potassium pentafluoroaluminate. The latter is then converted to anhydrous potassium cryolite as in the second stage of the first process. The process has been studied on 30 kg per batch scale.

The product has been tested and approved by Defence and the know-how has been released to National Fluorine Corporation, Bombay for commercial exploitation. The equipments required are available indigenously and are commonly used by leading producers of fluorine compounds in India.

Oxidized Starches

The Ahmedabad Textile Industry's Research Association (ATIRA), Ahmedabad has developed a process for the manufacture of oxidized starches by mild oxidation using hypochlorite. Mild oxidation of starch, particularly using sodium hypochlorite as oxidant, is relatively an economical process but this was not practised in India until

recently. The lack of development of the oxidative modification of starch was mainly due to two reasons. First, the oxidation of starch with hypochlorite is non-specific and extremely pH sensitive; hence it is invariably accompanied by substantial chemical breakdown of the polymer molecule. Secondly, the products prepared through such a non-specific reaction may differ greatly in properties from batch to batch. This can create problems between the manufacturer and users if stringent quality control of product properties is not maintained.

The ATIRA process has been patented (Indian Pat. 95454) and licensed to Maize Products Private Ltd, Ahmedabad. The firm manufactures oxidized starches under carefully controlled conditions. The viscosity of the starches is low and is particularly adjusted to the needs of the paper industry. The oxidized starch prepared by the ATIRA process is superior to conventionally oxidized starch in regard to adhesive strength, film strength and gel-forming tendency (*i.e.* retrogradation). Also, the oxidized starches prepared by the ATIRA process compare very well with some of the European and American samples.

A paper mill which manufactures writing and printing papers has been using the oxidized starch for sizing. The reports of this mill testify to the satisfactory performance of the oxidized starches. It has been found that 10% higher size add-on can be obtained compared to that obtained with conventional adhesives. Other advantages include: reduction in damages that usually occur during calendering or drying of the sized paper; reduction in ink consumption showing improved surface properties; and improvements in the quality of paper.

Oxidized starches find largest application in paper industry for surface sizing and pigment coating. The application of oxidized starch improves the bonding of the loosely attached fibres and fillers, thereby increasing burst, tensile and folding strengths of the untreated paper. Common thin boiling

starches cannot be used above 5% concentration because their pastes are viscous and these pastes retrograde rapidly, forming hard gels which subsequently damage the paper during drying on cylinder. Dextrins give fluid pastes but they are tacky and yellow to brown in colour. At equivalent concentrations oxidized starch gives better strength and lower stiffness compared to dextrins. Viscous pastes form a film on surface only, whereas fluid ones penetrate the paper web and interlock the fibres firmly. Hence, if an increase in the internal strength of the paper is required, oxidized starch as a very fluid paste should be employed. The fluid, oxidized starch pastes also permit higher filler properties in coating.

Desalination of Brackish Water by Reverse Osmosis

This award winning invention made by the Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar relates to the development of a tubular plant to separate water and other solvents from solution. The technique utilizes semipermeable membranes cast from specially prepared cellulose acetate, through which only water will pass and salt will be rejected with the effluent stream. The heart of the technique lies in the preparation of the correct type of membranes and the institute has acquired the necessary expertise for preparing the membranes, both of flat and tubular type. The reverse osmosis unit consists of aluminium pipes, within which a tubular cellulose acetate membrane, supported by nylon filter cloth as backing support, is inserted. Such an assembly, called 'module', is connected to a high pressure feed pump, accumulator, filtered unit and at the other end is provided with a pressure regulating valve. The plant operates at 600 psi pressure to process saline water of 5000-7000 ppm total dissolved solids (TDS).

A pilot plant for producing 20 000 litres of fresh water from brackish water per day was designed, assembled and continuously operated in the institute for over two months successfully to collect data on hardware, fouling of

membranes, polarization effect at the interface of the membranes, decline of flux due to fouling of membranes, etc. Based on the data obtained it is possible to scale up the unit to a larger capacity for processing saline water of 5000-7000 ppm TDS. All the equipments required, viz. high pressure pumps, transfer pump, booster pump, chemical feeder, back pressure regulating valve, needle valves, and rotameter, are indigenously available. The reverse osmosis technique has many advantages such as simplicity, ambient temperature operation, low energy consumption, removal of even bacteria and viruses, low capital and maintenance costs, and minimum corrosion problems.

CSIR SUPPORT TO RESEARCH

Completed Schemes

Genetic Basis of Nitrogen Fixation and Cellular Differentiation in Blue-Green Algae

With a view to understanding the genetic basis of nitrogen fixation and cellular differentiation, attempts have been mainly directed towards the induction of mutations lacking both nitrogen fixation and heterocyst differentiation. N-Methyl-N'-nitro-N-nitrosoguanidine (NG) was used as a most potent chemical mutagen and its inactivation and mutagenesis of a heterocystous and nitrogen-fixing blue-green alga, *Nostoc linckia* (Roth) Born et Flah, locally isolated from the rice field of the Banaras Hindu University (B.H.U.) campus, were investigated. The studies were made by Shri D. N. Tiwari, a CSIR research fellow, under the direction of Prof. Y. S. R. K. Sarma, at the Department of Botany, B.H.U., Varanasi.

Treatment of log and stationary phase cultures of *N. linckia* with 100 µg/ml of NG in the presence of dim light at room temperature (27°C) resulted in an exponential inactivation of log phase cultures (dividing cells) while the stationary phase cultures (resting spores) exhibited a sigmoidal type of survival. These results clearly indicated

Apart from the conversion of saline water to fresh water the reverse osmosis technique has varied other industrial applications, viz. concentration of whey, fruit juices and solutions of food and pharmaceutical products.

Two sponsored schemes for the concentration of cheese whey (for Amul Dairy, Anand) and removal of sodium chloride from iron-dextran complex (for Unichem Laboratories Ltd, Bombay) have been worked out successfully by the institute recently.

The know-how on reverse osmosis technique has been released through the National Research Development Corporation of India to three firms for commercialization. [See also *CSIR News*, 21 (1971), 96; 22 (1972), 56].

that NG primarily acts on replicating DNA and causes a higher frequency of mutations as compared to the resting conditions. Although immediate phenotypic expression of mutants could not be obtained after treatment with this chemical, diverse kinds of mutants with loss of nitrogen fixation were recovered in the nitrogen-free screening agar medium after subsequent propagation of NG-treated clones or populations in the ammonium growth medium. The mutants isolated after such methods exhibited diverse kinds of cellular morphology, pigmentation and nitrogen fixation. Leaving other morphological markers, these mutants after being characterized for their growth, cellular differentiation and nitrogen fixation, have been genetically grouped into five distinct classes with regard to nitrogen fixation, heterocysts and spore differentiation.

Mutant Strains

(1) Strains lacking nitrogen fixation, heterocyst and spore differentiation, e.g. N-1, N-3 and N-7 strains.

(2) Strains in which only nitrogen fixation and heterocyst differentiation are lost but not sporulation, e.g. N-2 and N-6 strains.

(3) Mutations with loss of only nitrogen fixation but capable of sporu-

lation and heterocyst differentiation, e.g. N-2 and N-5 strains.

(4) Non-nitrogen fixing and heterocystous strains unable to form spores.

(5) Heterocystous and nitrogen fixing strains with loss of sporulation, e.g. UVS-I and UVS-II.

Wild Strain

It is an unbranched filamentous alga with single heterocyst either in apical or intercalary positions at more or less regular intervals along the chain of beaded vegetative cells. The spores are formed in chain but a few vegetative cells adjacent to heterocysts remain as such. It forms distinct mucilaginous balls in the form of colonies on the agar medium. It does not require combined nitrogen sources since it is a strong nitrogen fixer.

The genetic dissection of the above five classes of markers clearly indicates that their phenotypic expression is independent of each other and governed by their respective genes and enzymes, although attempts to isolate non-heterocystous nitrogen fixer were unsuccessful. Further, analysis also suggests that the genes responsible for the above markers, which are mutated simultaneously or independently as a result of single-step mutation, are most likely to be closely linked. Since these markers did not revert, it may be concluded that they constitute deletion type of mutation in this particular alga.

Further, these mutants showed a requirement of combined source of nitrogen, i.e. nitrate or ammoniacal nitrogen, for their nourishment and they may represent a case of auxotrophic mutants in the blue-green algae. The complementation test with the help of the non-nitrogen fixers did not yield recombinants. The study of reversion and recombination of the above markers is under way.

The researcher Shri Tiwari was awarded the Ph. D. degree of B.H.U. for his thesis entitled 'Mutation and genetic basis of cellular differentiation in blue-green algae.'

Researches in Antibiotics and Fermentation : CDRI

V. C. VORA

Central Drug Research Institute, Lucknow

In the initial stages, emphasis was laid on the screening of molds for antibiotic activity. During this phase, except for the antibiotic X-29C—a quinonoidal compound—known antibiotics such as kojic acid and citrinin were isolated. From actinomycetes isolated and screened for antibiotic activity, a number of known and unknown antibiotics belonging to a wide spectrum of a variety of substances were isolated. Notable among them were some polyenes, resistomycin, actinomycins and echinomycin. A survey of mycotic infections (in collaboration with the Dermatology Department of Lucknow Medical College) in 173 human patients was carried out. A summary of work carried out so far and the future plan of work are presented.

The Antibiotics Division of the Central Drug Research Institute (CDRI), Lucknow was started as a small section in the Division of Biochemistry. Efforts in the beginning were concentrated on the screening of soil samples for isolating potentially useful antibiotic-producing molds—mainly penicillia and aspergilli—belonging to fungi imperfecti. During this period a *Penicillium* strain was isolated (identified by Prof. S. R. Bose of Calcutta as a non-pigmented strain of *Penicillium notatum* Westling) and designated as X-29C. The antibiotic was probably a quinonoidal compound judged by its reactions in alkaline pH and was found to be useful for topical application [*J. scient. ind. Res.*, **13B** (1954), 707; **14C** (1955), 142]. However, efforts to crystallize the antibiotic did not meet with success.

The results obtained while screening local soil samples for antibiotic-producing molds have been summarized in a paper published in 1954 [*J. scient. ind. Res.*, **13B** (1954), 372]. Out of the 67 active cultures isolated, 39 belonged to the genus *Aspergillus* and the rest belonged to the genus *Penicillium*. Fifty per cent of the molds isolated showed antibacterial activity on rapid screening and, barring a few, all those found active reproduced their activity when grown in Raulin Thom (inorganic medium) broth and Wickerham (complex organic medium) broth. Raulin Thom broth was found to be a very

satisfactory medium and, in some cases, superior to Wickerham broth. Sixteen molds, out of nineteen, which were investigated for metabolic products were found to produce kojic acid and the remaining three were producers of citrinin. Foster and Karrow [*J. Bact.*, **49** (1945), 19] similarly found that kojic acid was responsible for the antibacterial activity of a large number of molds.

Besides screening soil samples for antibiotic-producing molds, the Division studied the effect of antibiotics on the cytochrome oxidase of beef heart. An unusually high endogenous oxygen uptake was observed in controls in which cytochrome C, oxytetracycline and ascorbic acid were incubated. The enhanced oxygen consumption was subsequently shown to be due to the oxidation of ascorbic acid by oxytetracycline to the dehydro form [*Biochem. Biophys. acta*, **13** (1954), 505].

It was discovered that a large number of pathogenic bacteria inactivated chlortetracycline [*Experientia*, **10** (1954), 249]. Gram-negative bacteria inactivated the antibiotic to a greater degree than the Gram-positive ones. Maximum inactivation was brought about by *Pseudomonas aeruginosa* and *Proteus X19H*, which not surprisingly have been reported to be quite resistant to chlortetracycline.

Efforts were also directed towards devising a medium based entirely on

indigenous material for the assay of antibiotics [*J. scient. ind. Res.*, **11B** (1952), 551].

At this stage it was decided to ignore molds and concentrate on actinomycetes. Actinomycetes and soil bacteria were also screened for vitamin B₁₂ production. Actinomycetes were further screened for the production of the valuable enzymes amylase and protease. [*Antibiotics & Chemother.*, **11** (1961), 438; *J. scient. ind. Res.*, **13B** (1954), 743; **18C**(1954), 154].

At the same time, a survey of human skin fungi from 173 patients was carried out in collaboration with the Dermatology Department of the Lucknow Medical College. The survey [*J. scient. ind. Res.*, **17C** (1958), 87] revealed that *Trichophyton rubrum* was the most common species of dermatophyte in Lucknow. Yeast-like fungi were found to be the next as far as occurrence was concerned. *Trichosporon cutaneum* was reported for the first time in India.

Strains of *Candida albicans*, *C. tropicalis*, *C. parakrusei*, *C. guilliermondi*, *Cryptococcus* sp., *C. fermentans*, *Rhodotorula* sp., *Trichosporon* sp. and *Geotrichum* sp. were isolated from human faeces and diseased skin lesions.

Amongst the chemotherapeutic agents (31 in all)—diaryl sulphones, sulfoxides and sulphides—tested *in vitro* against *T. rubrum*, sulphides were relatively more effective. However, sulphides were not as effective as undecylenic acid. Potassium salt of benzyl isothiocyanate sulphonic acid, when tested against five dermatophytes and three yeast-like fungi, was found to be considerably more effective than undecylenic acid.

Almost all the strains of *T. rubrum* isolated were sensitive to griseofulvin. *M. canis* showed heavy growth in keratin-enriched Sabouraud's broth [*J. scient. ind. Res.*, **20C** (1961), 163].

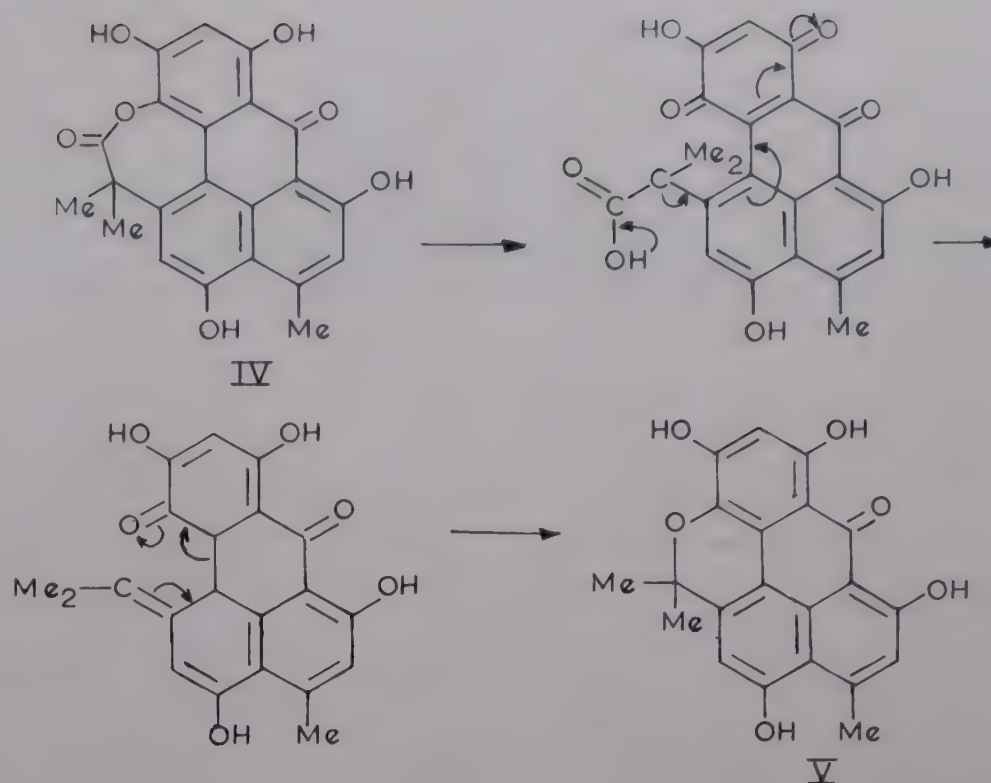
While testing the efficacy of griseofulvin against dermatophytes its cytological effect was also investigated. The cytological changes were similar in some respects to those reported for colchicine in higher organisms [*Naturwissen-*

schaften, **15** (1963), 1]. The abnormalities observed in the process of nuclear division and in nuclei suggest that there may be a disturbance in the synthesis of nucleic acid, affecting the general cell mechanism. It was also found that older mycelia remained unaffected by griseofulvin, and these may be responsible for reinfection.

Two hundred and twenty-nine soil samples, representing different soil types of India, were screened for the isolation of aerobic actinomycetes. Considerable variation was observed in the number and type of actinomycetes in different soils. Tarai soils of Uttar Pradesh gave higher counts of actinomycetes per gram soil sample as compared to other soil types of the state. In the case of Punjab soils, highest average counts of actinomycetes per gram of soil were obtained in samples from pedocal chestnut coloured soil of alluvial origin. However, the count for actinomycetes was lower as compared to Tarai soils of U.P.

Of the media used for planting the soils the synthetic medium of Gause was found to be the most suitable on account of the high average actinomycete counts per gram of soil, types of actinomycetes appearing, and the lesser representation of bacteria and fungi as parameters. The actinomycetes were selected on the basis of their gross morphology.

Three thousand and seventy-two actinomycetes cultures were grown in six types of liquid media and in shake flasks. The culture filtrates were tested for activity against *Agrobacterium tumefaciens*, *Candida albicans*, *Staphylococcus aureus* and *Salmonella typhi*. The percentages of antibiotic producers against the above mentioned pathogens were 2.73, 5.73, 29.89 and 2.69 respectively. (Investigation of the



Distribution of Aerobic Actinomycetes in India . . . USDA-PL-480 Scheme FG-IN-254: Final report obtainable from the Information Section, CDRI, Lucknow).

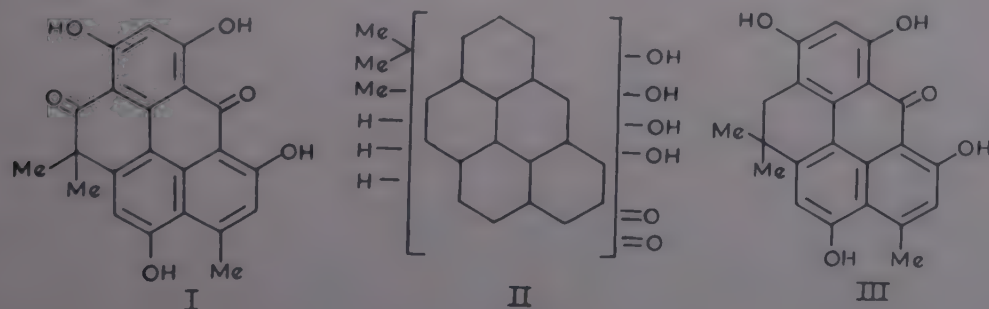
During the course of regular screening of soil samples and also under PL-480 scheme, a number of interesting antibiotics were isolated. Of these, Antibiotic X-340 (I) proved to be identical with resistomycin. However, Prof. Brockmann and his group, who were the first to isolate and work on the structure of resistomycin, were unable to decide the position of one methyl group and hence the problem of complete structural determination remained unsolved.

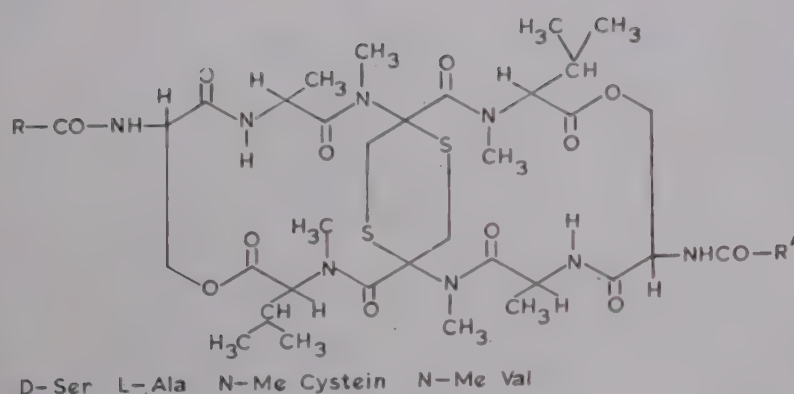
Chemical and physical data suggested a partial structure (II), in which were present two conjugated carbonyl groups each chelated to hydroxyl groups, one aromatic methyl group, three aromatic hydrogen atoms, one *gem*-dimethyl group, and four phenolic or enolic hydroxyl groups. The mole-

cule proved quite resistant to the usual degradative reactions, but a breakthrough occurred when a red crystalline sodium borohydride reduction product, rescarnone (III), was isolated. In this compound the lesser conjugated carbonyl group had been reduced. The same carbonyl group of resistomycin was also involved in the Dakin oxidation of resistomycin with alkaline hydrogen peroxide. This yielded a yellow lactone resistomycinolide (IV) and a deep red compound resistorbone (V). The yields of these compounds were low and as mentioned earlier other degradations were not rewarding. The complete constitution of resistomycin was determined by X-ray crystallography of dibromoresistomycin tetramethyl ether [*Chem. Commun.*, (1968), 374].

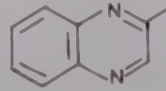
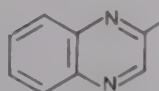
Resistomycin inhibits Gram-positive bacteria and is extremely stable. However, it is not very useful due to its lack of solubility and very low absorption.

Another antibiotic isolated in this laboratory was echinomycin (quinomycin) (VI) [*Indian J. Chem.*, **1**(1963), 277]. It inhibits Gram-positive bacteria and has a high antitumor activity; it is also extremely toxic. It has been reported [*J. Antibiot.*, **21**(1968), 465] that the heterocyclic moiety (quinoxaline-2-carboxylic acid) in this peptide

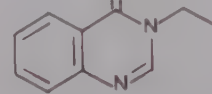
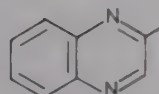




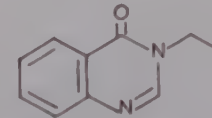
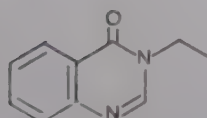
VI



VII



VIII



antibiotic can be replaced by quinaldinic acid (quinoline-2-carboxylic acid). The analogue had almost the same antibacterial spectrum but was more toxic. As quinoline is more toxic than quinoxaline it was assumed that either the whole or part of the toxicity of echinomycin is due to the heterocycle present. A compound, quinazol-4-one-3-acetic acid, had been synthesized in this laboratory and had been found to be non-toxic. This was incorporated in the fermentation medium of the echinomycin-producing culture (*Streptomyces* No. 63). After the fermentation was complete it was found that the culture had produced two antibacterial antibiotics—one was found to be the parent antibiotic and the other was an analogue in which one of the quinoxaline-2-carboxylic acid residues had been replaced by quinazol-4-one-3-acetic acid molecule. This was named quinazomycin (VII) [*Indian J. Biochem.*, 6(1969), 202]. A cell-free extract of this culture also synthesized echinomycin in the presence of precursors, ATP, mercaptoethanol and Mg^{++} . When the quinoxaline-2-carboxylic acid was replaced by quinazol-4-one-3-acetic acid, a new analogue was obtained in which both quinoxaline-2-

carboxyl residues had been replaced by quinazol-4-one-3-acetyl residues. This was named biquinazomycin (VIII) [*Indian J. Biochem.*, 7 (1970), 193]. Both quinazomycin and biquinazomycin had a high order of activity against *Staphylococcus aureus*.

Apart from the two interesting antibiotics mentioned above, several known and unknown antibiotics with antibacterial or antifungal activities have been isolated. Most of the antifungal antibiotics belong to the polyene group of anti-

biotics. Some of these are under investigation with a view to finding clinically useful antifungal or antibacterial agents. Mention may also be made of a powerful antitumor substance which to some extent resembles mitomycin C in its activity.

A polypeptide antibiotic from *Aspergillus rugulosus* strain with pronounced activity against *Candida albicans* *in vitro* proved to be totally ineffective against experimental *C. albicans* infection in mice. Similar was the fate of an antibiotic with activity comparable to that of chloramphenicol against a virulent strain of *Salmonella typhi* tested *in vitro*.

Current research programmes of the Antibiotics Division of CDRI are concerned with :

(1) Isolation of mutants of various bacteria, actinomycetes, etc. for commercial production of minor and major antibiotics. (Minor and major refer to the annual indigenous requirement in terms of import/production).

(2) Production of auxotrophs of microbial strains producing important amino acids such as *L*-lysine, *L*-glutamic acid, *L*-tyrosine and so on.

(3) Isolation of osmophilic yeasts and bacteria suitable for a fermentation

process for the industrial production of glycerol.

(4) Screening and isolation of actinomycete strains capable of converting more than 50% *L*-tyrosine in the substrate to *L*-DOPA.

(5) Isolation of better strains of yeasts with marked carboligase activity with a view to producing phenylacetylcarbinol by fermentation. Phenylacetylcarbinol produced is converted to *L*-ephedrine hydrochloride. (This work is being carried out in collaboration with Unichem Laboratories Ltd, Bombay).

(6) Identification and structural determination of an antitumor antibiotic. This antibiotic is of interest because of its mitomycin-like activity.

(7) Isolation of microorganisms capable of producing urokinase-like activity.

(8) Conversion of timber and agricultural waste by hydrolysis and subsequent fermentation to economically useful products.

PATENTS FILED

1382/72: Improvements in or relating to fabrication of silver chloride foil or electrodes, P.B. Mathur & R. Balasubramanian—CECRI, Karaikudi.

1489/72: A process for the production of wet-heat resistant and non-shrinkable leather, K.J. Kedlaya & T. S. Ranganathan—CLRI, Madras.

1490/72: A process relating to the production of 3-cyanopyridine from 3-picoline, a constituent of coke oven byproducts, S.K. Ray, K.P. Sharma, S. Basu, N.V.R. Apparao, H.S. Rao & A. Lahiri—CFRI, Dhanbad.

1491/72: An electrochemical process for the production of *p*-toluidine from *p*-nitrotoluene, H.V.K. Udupa, M.S. Venkatachalapathy, S. Chidambaram & R. Sridharan—CECRI, Karaikudi.

1714/72: Electronic high voltage detector, V.N. Sharma, V.K. Nayyar & V. Venugopalan—NPL, New Delhi.

1719/72: An improved method for the extraction of metals from solution by solid state adsorption techniques, A. K. Saha, M.J. Shahani & V. A. Altekar—NML, Jamshedpur.



CSIR NEWS

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- 9 MAY 1973

CSIR SOCIETY MEETING

Prime Minister Emphasizes Role of Science and Technology in National Development

Presiding over the meeting of the Society of the Council of Scientific & Industrial Research, held at Parliament House, New Delhi on 30 March 1973, Shrimati Indira Gandhi, Prime Minister, emphasized the important role which science and technology have played and must continue to play in national development. Stressing the need for greater emphasis on the utilization of indigenous technology, the Prime Minister said that this effort would call for some changes in the guidelines in regard to import of technology where the country's experience so far has been far from satisfactory. CSIR should be actively involved in the formulation of these guidelines, she said. The Prime Minister also called upon the scientists and technologists to view their work in the larger perspective of the country's social and economic goals. Only by a direct application of science and technology in every-day life could the nation as a whole develop a scientific attitude, she added.

Welcoming the Prime Minister and the members of the Society, the Vice-President of CSIR, Shri C. Subramaniam, indicated the changes in the organization, structure and management of CSIR consequent on the Sarkar Committee's Report and decisions taken thereon by the Government. Some of the changes had already been brought about under the existing Rules & Regulations, but others called for some amendments to the Rules & Regulations of the Society. The central theme of the Sarkar Committee's

Report is, in regard to decentralized, internalized, collegiate management, giving the necessary authority and responsibility down the line. The report also lays emphasis on research relevant to social and economic growth and CSIR's research interlinked with NCST (National Committee on Science & Technology) plans. Yet another recommendation is that the control of finances should be budgetary rather than regulatory. The amendments reflect these changes. Thereafter the Society approved the changes in the Rules & Regulations as a result of the Government's acceptance of the Sarkar Committee's recommendations.

In her concluding remarks, Shrimati Indira Gandhi indicated that the changes in the Rules & Regulations marked the completion of the phase of organizational and managerial reforms in CSIR. The Council should now devote its energies to more efficient planning and management of research and development work under way in its laboratories and to accelerate the commercialization of the know-how already developed. This would call for concentration of available resources on a smaller number of larger projects.

The Prime Minister emphasized the importance Government attaches to upgrading university research and making it more relevant to national needs. She called upon CSIR to take the lead under its new policy of research support to involve the universities more closely in solving national problems. She indicated that Government was

committed to the new policy aimed at ensuring that the bulk of university research is supported by grants made by major scientific agencies.

BITM's New Gallery on Transport Opened

A new gallery on 'Transport' was inaugurated at the Birla Industrial & Technological Museum (BITM), Calcutta by Shri T. A. Pai, Union Minister for Heavy Industries on 26 March 1973. The gallery depicts the story of the development of transport on land, on water and in air from time immemorial. The vital role that the mode of transport has played in man's struggle for existence and in his subsequent civilized life has been displayed in the gallery.

The exhibits, 250 in all, have been displayed through working models, dioramas, murals, original full-scale pieces, photographs, translites and paintings. Arranged in three halls, the exhibits cover a floor space of 290 square metres. Some of the interesting exhibits displayed in the gallery relate to: regional influence on transport; eighteenth-century Calcutta transport; story of wheel; Tata Mercedes Benz vehicle engine; model of Concorde; Saturn V rocket model; diorama on space flight; ropeway and monorail; cranes and conveyors; early attempts on rail; electric and gas turbine locomotive; scheme of metropolitan transport project; collection of mascots and spark plugs; and first horse-drawn tram of Calcutta.

Chemical Models of Enzymatic and Immunological Reactions

This is the subject of investigation to be taken up by Prof. P. K. Bhattacharyya

of the Department of Organic Chemistry, Indian Institute of Science, Bangalore, under a CSIR Silver Jubilee award, as already announced in *CSIR News* [30 March 1973, p. 47].

The proposed project would be mainly concerned with the syntheses and studies with models of a few commercially important and clinically applicable enzyme systems.

The use of enzyme models in place of enzymes has several potential advantages :

(1) Most of the models envisaged are stable small molecules and as such are applicable in extremes of temperature and pH conditions which would denature the natural enzyme proteins.

(2) The models have the potential advantage of being more economic than the enzymes and can be produced in high tonnage in common industrial reactors.

(3) The intriguing possibility of the application of simple models of missing enzymes in the treatment of genetic disorders may offer attractive lines of investigation.

Cephalosporin amidase model

The preparation of semi-synthetic cephalosporins require, as raw material, 7-aminocephalosporanic acid which is usually made by mild chemical hydrolysis of cephalosporin C. The enzymatic method is not very popular as very few microorganisms have been known to contain cephalosporin amidase and the activities are low. The yields in chemical hydrolyses seldom exceed 50%. However, in recent years, high yields have been claimed (in patents) by using involved and multi-stage chemical procedures.

Since the annual turnover in semi-synthetic cephalosporin is more than \$ 100 million, it is desirable that a model be developed for the specific hydrolysis of cephalosporin C to 7-aminocephalosporanic acid.

Template synthesis of semi-synthetic penicillins and cephalosporins

In biological systems, macromolecular synthesis of polynucleotides and polypeptides is carried out on templates. The synthesis of a few templates

for the preparation of a peptide, ampicillin—a popular semi-synthetic penicillin—from 6-aminopenicillanic acid and α -phenylglycine is under investigation. It is proposed to extend such model approach to a popular cephalosporin, cephalexin.

Asparaginase model

Some L-asparaginases of microbial origin are used in the treatment of leukemia. Some leukemic cells have limited ability to synthesize asparagine; the administration of the enzyme L-asparaginase restricts the availability of L-asparagine for protein synthesis still further.

Since L-asparaginase gives rise to immunological sensitization, this therapy is beset with many problems. A simple organic molecule with the same catalytic activity as that of the enzyme may thus have a good therapeutic potential.

Other models of enzymes

Models of many other enzymes such as acid lipase, acid protease, and alkaline protease of industrial and therapeutic importance may also be designed.

Immunological models of allergenesis

The immunological reactions use the same physico-chemical forces for specific protein-protein or protein-membrane interactions as those involved in the enzyme-substrate orientation processes. One of the major problems in this area is the development of penicillin allergy, as 3-5% of the population suffer from this allergy. Other allergy problems of increasing clinical importance are those of aspirin and thiamine sensitivity.

Polymers have been designed with the structural elements of penicillin for studying interactions of haptenic groups and receptors in the blood of sensitive subjects, as well as for studying antigen-antibody binding. It is proposed to study on such models the effect of various analogues of penicillin interfering with the process of binding of hapten-receptor or antigen-antibody.

At a later stage this model approach will be extended to the study of aspirin and thiamine allergy.

Part of the studies, relating to immuno-chemical aspects, will be carried out in collaboration with the School of Medical Sciences, University College of Medicine, Calcutta.

Thickening of Tar from Coke Ovens of Bhilai Steel Plant : CFRI Suggests Remedial Measures

For sometime past, operational troubles were being experienced in the coke ovens of the Bhilai Steel Plant due to the thickening of tar. The Central Fuel Research Institute (CFRI), Dhanbad, undertook, on sponsored basis, investigations into the causes. Both in-plant investigations on the operating conditions at Bhilai and pilot plant investigations at CFRI to determine whether any particular coal in the blend was producing such a tar were carried out.

Investigations at Bhilai revealed that undercharging of the ovens was the main cause of degradation of the tar. It resulted in more free space than the designed figure of 350 mm being left over the coal charge and consequently higher temperature at that zone. Thus the fluid tar, initially formed, was subjected to cracking, and this adversely affected the quality and quantity of the tar.

Pilot plant studies showed that no individual coal in the blend was responsible for the formation of viscous tar.

The corrective measures suggested by CFRI are as follows :

(1) Undercharging of ovens should be stopped immediately. Ovens which are in the list of planned undercharging may be blanketed off if considered worthwhile.

(2) Improperly aligned charging car hoppers and defective levelling bars should be rectified immediately.

(3) All the hoppers of the charging car should be properly loaded and effective steps should be taken to ensure the correct height of the coal charge in all the parts of the ovens.

Selected Russian Articles on Metallurgy

The Russian Science Information Centre of the Indian National Scientific Documentation Centre (Insdoc), New Delhi, has started issuing a new publication entitled 'Selected Russian Articles on Metallurgy' with a view to keep the Indian industries informed about the latest Soviet developments in this field.

The first issue of this serial publication (56 pages), brought out in February 1973, contains English translations of 10 Russian articles. The following topics, among others, dealt with in the inaugural issue give an idea of the coverage: Progress of iron and steel industry in USSR; Slag formation and desulphurization of metal in large capacity open-hearth furnace; Improvement of the properties of foundry pig iron; Hardness and corrosion resistance of nickel alloys with molybdenum and tungsten; Methods of reducing metal off-cuts during rolling of large ingots; Effect of ultrasound on the strength of mould mixtures; and Application of computers for distributing industrial assignments among steel plants.

It is proposed to include in future digests of articles, instead of complete translations, in order to give a wider coverage of Russian work.

Copies of the publication may be had, on request, from: The Director, Indian National Scientific Documentation Centre, Hillside Road, New Delhi 110012.

Plastic Pipes in Water Supply and Drainage

The Central Public Health Engineering Research Institute (CPHERI), Nagpur has brought out a manual on 'Plastic Pipes in Water Supply and Drainage'. The 46-page publication contains information on the types of plastic pipes available in India, their properties, factors governing their choice, and the methods of jointing, installation and testing of pipes under eight chapters: (1) History of use of plastic pipes in water supply and drainage;

(2) Process of manufacture of thermoplastic pipes; (3) General characteristics and choice of material; (4) Recommendations for laying and jointing polyethylene pipes; (5) Recommendations for laying and jointing of unplasticized PVC pipes; (6) Necessity of testing; (7) Long-term stress rupture testing; and (8) Testing of installation.

BTRA's Fifth Technological Conference

The fifth Technological Conference, organized by the Bombay Textile Research Association (BTRA), Bombay, was held at BTRA on 23-24 February 1973. The conference was inaugurated by Shri Pratap Bhogilal, Chairman of BTRA, who in his address drew the attention of the delegates to the Government's intention to collect a cess of 1% on the turnover of the industry to meet the higher outlays on R & D in this industry.

Eleven papers dealing with various aspects of textile technology were presented. A brief account of the papers presented follows.

Recent trends in chemical finishing of natural fibres were surveyed in a special lecture by E. H. Daruwalla of the University Department of Chemical Technology, Bombay University.

The results of studies on irregularities in Whitin high speed draw frames constituted the subject of a paper presented by N. Balasubramanian and V. K. Bhatnagar of BTRA. It has been found that yarn strength and evenness suffer only marginally but end-breakages at the ring frame get affected because of the irregularities in the drawing sliver. The use of high tension draft between the calender roller and the front drafting roller was found to be one of the causes for the high irregularity in the mills' Whitin draw frames in carded mixings. Eccentric running of the coiler driving shaft was another cause of irregularity. The defect arose from the wearing out of the shaft at the bearing of the gearing end. The condition of the third bottom roller, defective setting of stop-motion setting screws in the top arm and de-

The manual is expected to serve as a guide to engineers, architects, plumbers, manufacturers and others in the proper selection, installation and use of plastic pipes available in the country.

Enquiries regarding the manual may be addressed to: The Director, Central Public Health Engineering Research Institute, Nagpur 20.

fects in the gear drive were found to have a significant influence on sliver irregularity on the draw frames. The choice of break draft was dependent upon the front zone roller setting. At close front zone settings, a higher break draft resulted in more regular sliver but at wide front zone setting a lower breakdraft was advantageous from the point of view of regularity.

A comparison of the relative strength and elongation of Tetoran (polyester), cotton and polyester-cotton blend (67:33) at different stages of manufacture (i.e. single yarn, double yarn, multiple strand and fabric) was made by N. Balasubramanian and S. K. Nerurkar of BTRA. The improvements in strength and elongation from doubling were more prominent in the blend and Tetoran yarns than in cotton yarns. Further, the strength losses from short to long specimen and from single to multiple strand were more marked in the blend than in cotton due to the higher variability in elongation in the former. At the same time, the assistance derived from interlacement of the weft was more in the blend than in cotton and, as a result, the blend, though inferior in strength to cotton at the yarn stage, becomes comparable to it at the fabric stage.

The difficulty faced by the textile industry in ensuring plentiful supply of clean soft water, especially in large metropolitan cities like Bombay, prompted M. D. Dixit and S. M. Doshi (BTRA) to suggest practical considerations in the reuse of water in textile mills.

Among the many processes utilize in the removal of impurities from

cotton fabrics the kier boiling process is probably the next in importance to desizing. While the desizing process is mainly useful in removing the bulk of the added sizing materials, it is the alkaline scour in the pressure kier which effects the removal of the natural impurities in the cotton and thus enables the processor to obtain an absorbent fabric suitable for bleaching and dyeing. Some practical aspects of the pressure kier boiling process were discussed by M. D. Dixit, C. A. Desai and S. S. Shivashankar.

T. S. Ramamoorthy and coworkers (BTRA), in their paper, presented the salient features of the BTRA mechanical doffing trolley for weft pirns and critically evaluated the auto-doffing systems adopted in other countries, thereby bringing out the advantages to the industry in adopting the doffing system developed by BTRA.

With the advent of the newer synthetic fibres several new methods using high temperatures have been developed for the colouration of textiles containing these fibres, either alone or in blends with natural fibres. When using these methods, the textile material may be dyed in either aqueous or non-aqueous systems. Pressure beam dyeing and pressure jet dyeing are typical aqueous systems, whereas thermosol, fluidized bed, high temperature solvent, molten urea and thermo-transfer techniques are typical of non-aqueous systems. The 'HT' steaming technique utilizes superheated steam at atmospheric pressure, and is expected to be capable of being extended to other processing operations also, such as scouring, bleaching and finishing. S. M. Doshi and A. S. Gore (BTRA), in their papers, provided some practical considerations for obtaining satisfactory dyeings on polyester/cellulosic blends and showed how high temperature steam has a clear edge over the conventional methods of dyeing and printing textiles. They recommended the use of high temperature steam to obtain quality dyeings.

Large quantities of furnace oil are being used by textile mills for produc-

ing steam which is utilized in space heating for humidification, in wet processing and for drying. The acute supply position of furnace oil and its increasing cost have made it necessary to take measures for the efficient combustion of the furnace oil, and to utilize the heat produced in generating steam efficiently. Proper utilization of steam can lead to considerable economies in the consumption of furnace oil. How proper utilization of fuel can lead to considerable economies in the consumption of furnace oil in textile mills was discussed by M. D. Dixit (BTRA), who also described some of the me-

thods by which fuel consumption can be reduced.

From the point of view of export promotion the paper entitled 'Spot cleaning of oil stains in grey fabrics', by G. R. Pillai of BTRA, was of considerable interest. Pleading for improvement in fabric processing, Pillai suggested methods for checking stains, inspection and spot cleaning of oil stains on fabrics in the grey state.

Some of the subtle aspects of colour-woven fabrics with special reference to defects peculiar to this class of fabric were presented by S. S. Moraye and coworkers (BTRA).

PROGRESS REPORTS

RRL, Jorhat Annual Report 1970-71

The annual report of the Regional Research Laboratory (RRL), Jorhat for 1970-71, published recently, shows that during the year the laboratory made concerted efforts to identify areas of immediate socio-economic importance with emphasis on the every-day needs of the common man, viz. food, clothing and shelter. The 72-page (demy 4to) report also shows the laboratory's accent on the development of processes and products whose commercial utilization involves not only low capital investment but leads to a high return of capital, the underlying idea being that such processes would enable unemployed educated people to take them up for exploitation.

In the field of paper, cellulose and hardboard the laboratory's processes developed during the year relate to the production of: carbonizing tissues from rags; flax or hemp pulp; a coating composition based on indigenous chemicals for the manufacture of thermographic paper; envelope paper from industrial waste; gaskets from bamboo pulp; and a coating composition required for producing paper twine from unsized or kraft paper. A major achievement in this area was the development of low-cost paper houses. Estimates show that such houses cost

only Rs 2-3 per sq ft whereas conventional houses cost Rs 7-10 per sq ft. About 2.5 tonnes of paper board have been produced at a mill for constructing houses of different designs and for collecting performance data.

In the field of silicate technology, the laboratory has developed an improved ion exchange process for the production of silica gel which replaces the cumbersome and time-consuming dialysis method. Silica gel prepared by the new method is of high purity (99.99%) and is suitable for use in chemical and pharmaceutical industries and as a desiccant. With a view to utilizing clay from Garo Hills the laboratory has taken up investigations on the production of processes for aluminium sulphate, hydrated aluminium chloride, china clay, and molecular sieves using the Garo Hill clay as the source. The process developed for aluminium sulphate consists in activating the clay at a suitable temperature, followed by digestion with sulphuric acid, and concentrating the filtered mother liquor. Similarly, the process for dehydrated aluminium chloride, developed on a laboratory scale, consists in activating the clay and digesting with hydrochloric acid. Molecular sieves (2 Å, 4 Å and 8 Å) in sodium zeolite have been synthesized and are being evaluated.

Tests on the carbon black samples prepared by the laboratory from Assam coal have shown that the product is equivalent to thermal grade carbon blacks. It has also been found that the quality of carbon black could be improved by increasing the residence time of coal in the reactor.

A detergent formulation based on the ash obtained from paddy husk has been developed, and the cost of production has been found to be Rs 1.85 per kg. Following the release to Dhannuka Industries of the process for the production of microcrystalline wax from wax scrappings, a detailed design of a plant of 150 kg treating capacity per batch, along with cost estimates, was worked out for the firm. Further investigations on the process from the point of view of raw material flexibility have shown that bottom sludges can also be utilized for the production of microcrystalline wax.

As part of an integrated scheme for the utilization of chlorobenzene for the synthesis of important chemical and pharmaceutical intermediates, work on the synthesis of *p*-anisidine, *p*-acetamol and phenacetin was taken up. Processes for phenacetin and *p*-anisidine have been developed. At the instance of Hindustan Photo Films, a process for the production of triphenyl phosphate, an important plasticizer used in protographic industry, by the reaction of phenol and phosphorus oxychloride was worked out. Work on the process for the production of tricresyl phosphate was under way. Using cyclohexanone derived from petrochemical industry as the starting material, a process for caprolactam has been developed. Conversion of caprolactam to lysine through benzoyl aminocaproic acid has been completed on a laboratory scale. An alternative route for lysine starting from cyclohexanone-2-carboxylate by a double Schmidt reaction with sodium azide has also been developed. Starting from isobutyl alcohol the total synthesis of pantothenic acid, an important member of vitamin B group, was achieved.

In continuation of earlier work, the bacteria and yeast strains isolated by

the laboratory were tested for maximum production of single cell protein (SCP) from petroleum hydrocarbons. Improved techniques of cultivation have been developed which led to a high cell concentration 10 g (dry weight) per litre or more, resulting in increased yield. The SCP was processed by centrifugation and solvent extraction to obtain an odourless light cream coloured product. The organism used in these studies was *Endomycopsis lipolytica*. The nutritional evaluation of the product from gas oil on rats was carried out. SCP was found to replace casein at 10% protein level. Experiments on chronic feed trials as well as reproduction trials were under way.

Extensive tests on the water filter candles developed by the laboratory have shown that they can give bacteria-free drinking water. A salient feature of this technology is that the capital investment required for setting up an industrial unit (50 candles per day capacity) is of the order of only Rs 11 000 and is capable of giving a daily return of Rs 250. Further work on the utilization of different types of clays for the production of candles was taken up.

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

Coconut Husk Chipping Machine

Particle boards are presently being made from chips of wood, bagasse and paddy husk. Manufacture of such boards entails the use of a large quantity of imported adhesives. Substantial cost reduction is possible if coconut husk is used in the manufacture of particle boards. Huge quantities of coconut husk are being wasted. The Central Building Research Institute (CBRI), Roorkee has developed a machine which performs the chipping of the coconut husk without the separation of the pith. Investigations at CBRI and at the Forest Research Institute, Dehra Dun have shown that if coconut husk is chipped without its pith being separated, good quality particle

A significant step toward bringing the results of its investigations to the benefit of common man was the assistance rendered by the laboratory to a village in Nagaland in regard to the cultivation of citronella and distillation of the oil.

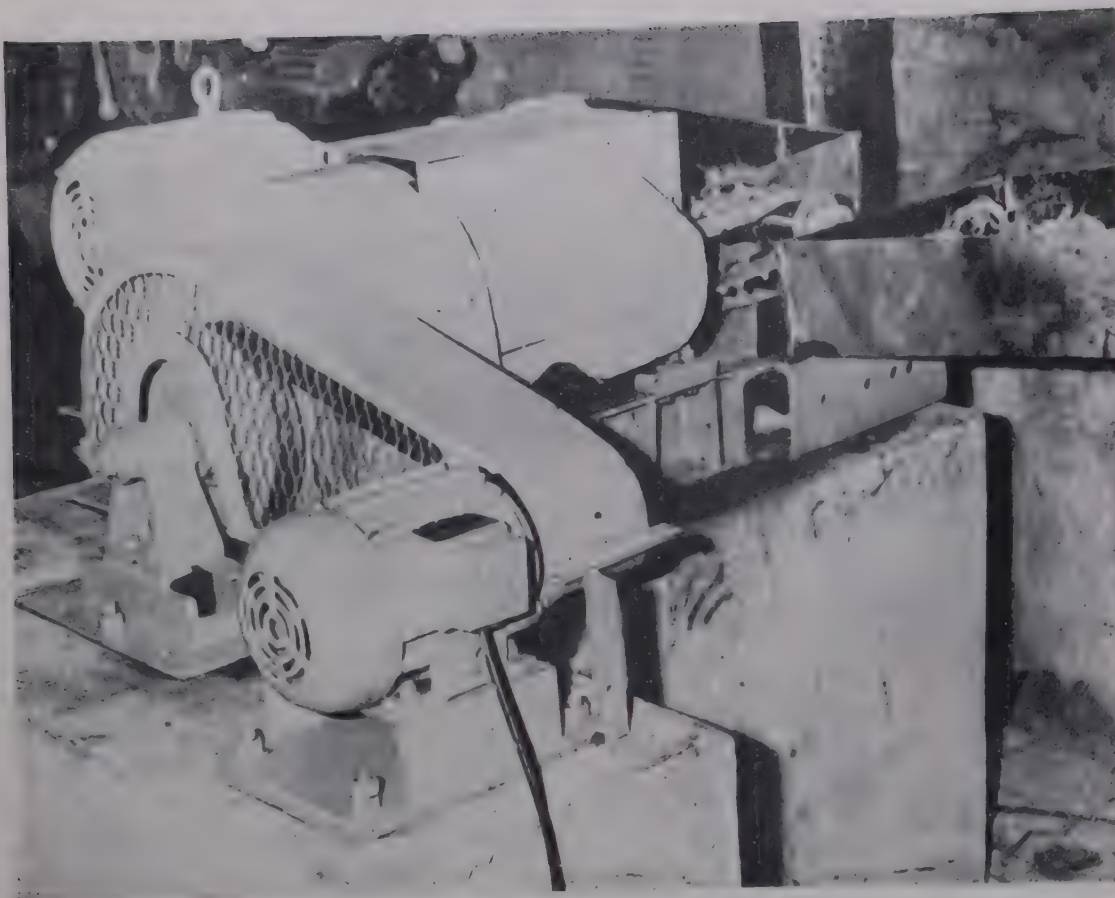
A batch unit for producing oxalic acid (25 kg/day) from saw dust has been set up. The yield of oxalic acid (99% purity) was 40%, and cost of production, Rs 3/kg. Large scale experiments (5 kg/batch) for the recovery of tartaric acid both from tamarind leaves and pulp were carried out. The yields of tartaric acid were 7.25% and 10.87% from the leaves and pulp respectively.

Other notable achievements of the laboratory were the development of a paper twine making machine and a high-speed gear attachment for bicycles. The machine can form twine of about 1.2 m diam at the rate of 90 ft/min.

Seven processes were released to industry for commercial utilization: caffeine from tea waste, grease-proof paper; lamination of panels, particle boards and hardboards; matrix board; microcrystalline wax; silica gel; and water filter candles. Applications in respect of seven processes/products were filed.

boards can be made from these chips with little or no adhesive. The pith embedded in the coconut husk fibres contains reactive ingredients which, during the process of making particle board, undergo a chemical change and impart sufficient bond strength between the chips to form a strong board, thereby avoiding or minimizing the requirement of resin adhesive. The machine comprises two sub-assemblies, feeding head and cutting head, both of which are powered by separate motors. Chips of different thickness required for specific purposes can also be obtained from the machine.

A prototype has been fabricated at CBRI and it has been tried extensively



Coconut husk chipping machine developed by CBRI, Roorkee

and the performance found satisfactory.

The machine has been fabricated with the use of indigenously available parts. Any small scale industry having the facilities of casting, machine shop, welding, etc. can take up the production of the machine.

The output of the machine is related to the speed of feeding; an average output of nearly 75 kg per hr is possible. The maximum horse power required by the machine is 5 hp. The cost of fabrication has been estimated at Rs 5000 but may come down when the machine is produced commercially.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

High Speed Bicycle Gear

Geared bicycles with four or five speeds and with provision for change of speed during operation are manufactured abroad. In this arrangement the chain slips from sprocket to another sprocket giving rise to different speeds. The

speed variation from the lowest to the highest range is not much and such bicycles are quite costly.

With a view to making the bicycle semi-automatic with a better speed, the Regional Research Laboratory (RRL), Jorhat had designed a device by which the speed of the bicycle can be increased twice or more without much increase in the effort compared to the effort required in pedalling a normal bicycle. The device is mounted inside a hub which can be mounted directly on the axle of the hind wheel without any modification of the frame. The device can also be used in the ordinary bicycles by replacing the hub and using shorter spokes in place of standard spokes. The attachment can also be made a regular part of new bicycles. The components needed could be manufactured indigenously.

In this device for smooth riding, one clutch is provided by which the high speed gear can be disengaged exclusively, causing the bicycle to move like an ordinary bicycle with normal effort. As speed is picked up, the high speed gear can be engaged, causing the bicycle to move at greater speed without

much increase in the effort. The engagement and disengagement operations are manual.

The attachment can be made as a separate unit or can be manufactured by bicycle manufacturers using one or two additional machine tools. In view of its low cost the attachment is expected to find a wide market.

The raw materials required for the fabrication of the attachment can be procured indigenously. The capital cost for a plant capable of producing 50 such attachments per day is estimated at Rs 9.75 lakh (Rs 8.15 lakh on land, building and plant and equipment, and Rs 1.60 lakh as working capital). The cost of production per unit comes to about Rs 54. If the capacity of the plant is increased to 100 pieces per day, the cost per unit would be reduced to Rs 40 per unit with a slight increase in the capital outlay. For a plant of 200 pieces per day capacity, the cost of production of the attachment unit would be Rs 36

High speed bicycle gear designed by RRL, Jorhat



only. In the last case the total capital outlay would be Rs 16.29 lakh

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Steam Distillation Plant for Recovering Essential Oils

A steam distillation unit wherein essential oils can be recovered from essential oil bearing plants has been designed and fabricated by the Regional Research Laboratory (RRL), Bhubaneswar. After distillation is complete, the waste material is replaced by fresh stock with negligible loss of heat and time. Such units are specially suited for operation under conditions prevalent at raw material sites, and readily available fuels such as firewood can be utilized. The quality of oil is comparable to that obtained under laboratory conditions by keeping the charge and oil away from the high temperature contacts. Investment and operational costs are low.

Essential oils obtained by steam distillation are consumed mainly in the pharmaceutical and perfumery industries. The residual grass may be used in the manufacture of press boards, thatching houses, as fodder and as fuel in distillation industries

An experimental plant capable of handling 100 kg of raw material per charge has been in operation for four months at the laboratory.

The investment on a plant of 100 kg per charge has been estimated at Rs 5500. The cost of production in the case of lemongrass oil has been estimated at Rs 30-36 per kg. The plant can be easily fabricated indigenously.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Courses on Materials Management and General Administration

The first courses on Materials Management and on General Administration

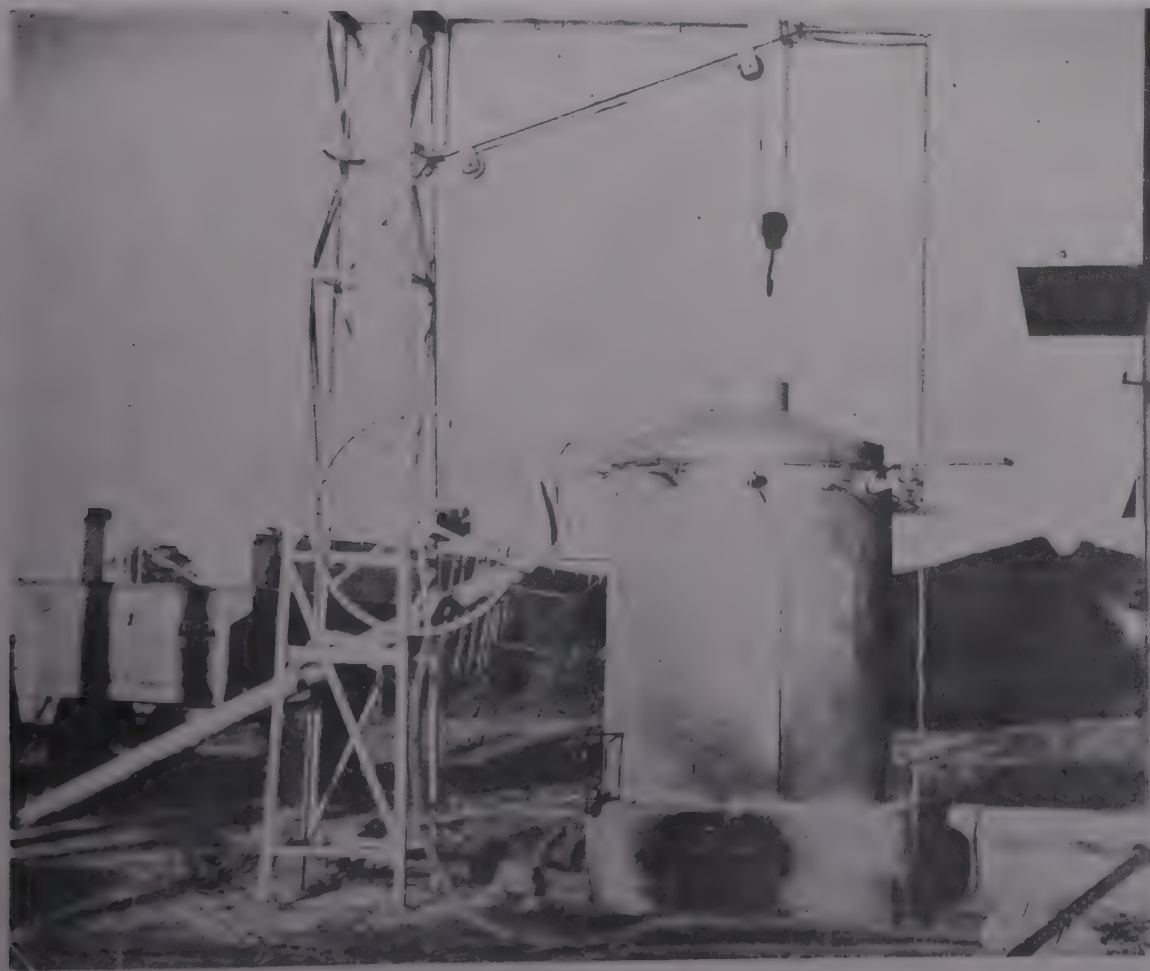
were held from 29 January to 5 February 1973 and from 22 February to 1 March 1973 at the Central Mechanical Engineering Research Institute, Durgapur, and the Indian Institute of Experimental Medicine, Calcutta respectively under the management training programme being conducted by the Research Survey and Planning Division (RSPD) of CSIR in collaboration with the Administrative Staff College of India, Hyderabad. The Materials Management course was attended by stores/purchase officers of CSIR laboratories and CSIR-aided research associations situated in eastern India; the course on General Administration was attended by the administrative/section officers of the laboratories and research associations.

The Materials Management course covered lectures on : functional role of materials managers in research and development; organization of inventory management and control; application of statistical methods in inventory management and control; stores organization and layout; purchase procedures; and demand forecasting with special reference to scientific research.

The course achieved the dual objective of creating an awareness of modern methods of materials management amongst the participants and also of the proper appreciation of their roles in their functional areas in an R & D organization like CSIR. The participants expressed the need to streamline the various procedures and to put their secondary but important function on more organized lines.

The course on General Administration covered mainly the areas of manpower planning; personnel management; work study methods; O & M appraisal system; and motivation. Discussions related to : delegation of functional powers, conflict resolution between different sub-systems of the organization, and recruitment procedures.

With the success achieved in these two courses, the RSPD proposes to conduct two such courses at the Central Food Technological Research Institute, Mysore. Also, it has been



Steam distillation plant developed by RRL, Bhubaneswar for recovering essential oils

proposed to hold training courses in R & D management, and management accountancy in the near future.

Prof. N. Majumder

Prof. Nityananda Majumder, Professor of Sanitary Engineering, All India Institute of Hygiene and Public Health, Calcutta, has been appointed Director of the Central Public Health Engineering Research Institute (CPHERI), Nagpur. He took over on 2 April 1973.

Born on 19 September 1919 at Burdwan, Prof. Majumder had his early education at Kalimpong and higher education at the Calcutta University from where he obtained his B.E. degree in 1941. Proceeding to USA for higher studies, he obtained his M.S. degree in Sanitary Engineering in 1945 from the Harvard University. He subsequently spent another year in the same university for advanced training in industrial hygiene.



As a member of the executive council of CIPHERI for many years, Prof. Majumder has guided its research and developmental activities. He is also a member of the editorial board of Indian Journal of Environmental Health, being published by the institute.

Prof. Majumder has been actively associated with teaching and research in the field of public health engineering since 1942. He was appointed Professor of Sanitary Engineering at the All India Institute of Hygiene and Public Health in 1956. He has also served as an expert member on various committees set up by the Government of India. He had served as consultant and adviser to World Health Organization on public health engineering education. Recently, he completed an assignment with WHO at the Rangoon Institute of Technology.

He has won several awards and prizes and has a number of research papers to his credit.

He is a Fellow of the American Society of Civil Engineers, Fellow of the Institution of Engineers (India), Fellow of the Indian Public Health Association, and currently, President of the Indian Association for Water Pollution Control.

PATENTS ACCEPTED

Indian Pat. 129706

Improvements in or relating to continuous countercurrent ion-exchange apparatus
M.N. Prajapati, B.D. Dasare &
N. Krishnaswamy
CSMCRI, Bhavnagar

The patent covers the improvements effected in the continuous countercurrent ion-exchange apparatus used for water softening, demineralization of brackish waters, recovery of valuable constituents in traces, or removal of certain harmful constituents either from industrial waste water or from any other solution. A simple mechanism is used for resin transfer, control of resin transfer rate, and avoidance of mixing of various solutions carried over along with the resin transfer.

The apparatus is designed in such a way that the process is truly continuous and does not involve any temporary stoppage of the flow of the treated liquid, or the reversal of flow at any stage. A continuous flow of ion-exchange resin and the solution to be contacted is effected in a countercurrent fashion without the use of complicated valves, relays, timers, etc. Compressed air is successfully used to transfer the resin through various stages such as exhaustion, regeneration and rinsing. The resin transfer rate is controlled by manipulating the flow of the compressed air. A filtration device is introduced which removes almost all the liquid carried over along with the resin transfer and the air jacket allows the compressed air to escape. The rinsing column is designed in such a way that maximum efficiency is achieved in the rinsing operation.

The apparatus has been successfully used for the continuous production of treated liquids with minimum resin inventory, with minimum rinse water

requirement, with maximum regeneration efficiency and with the production of treated liquid of desired quality. The desired quality of treated liquid can be maintained by adjusting the resin transfer rate and the regeneration level and thus it is possible to cope with the fluctuations in the composition of the influent water solution without deleterious effects on the quality of the effluent. All the components are indigenous.

PATENTS SEALED

121760: Improvements in or relating to the process for the synthesis of iso-amyl ethyl silicates and cetyl ethyl silicates, R.S. Bhute & M.A. Sivasamban—RRL, Hyderabad.

124383: A process for the reduction of a vat dye or similar type of dyes, H.V.K. Udupa, M.S. Venkatachalapathy & S. Chidambaram—CECRI, Karaikudi.

125684: Improvements in or relating to the production of a material suitable for making matrix board, N.C. Nandi, C.N. Saikia, B.P. Chaliha, S.B. Lodh & M.S. Iyengar—RRL, Jorhat.

126062: An improved method for the removal of vanadium from vanadium pig iron, V.A. Altekar & P.P. Bhatnagar—NML, Jamshedpur.

126064: Improvements in or relating to wire helix winding for electronic devices such as travelling wave tubes, Jaswant Singh—CEERI, Pilani.

126178: Pressure vessel fabrication machine, A.K. Das, B.M. Sen, S.S. Seth & S.K. Nandi—CMERI, Durgapur.

126552: A process for production of moulded shapes as an improved charge for ferro-silicon and/or ferro-alloy manufacture, A. Lahiri, A.K. Moitra, N.G. Banerjee, A.K. Chakravarthi, R. Ghosh & N.G. De—CFRI, Dhanbad.

PATENTS FILED

1751/72: Improvements in or relating to ultrasonic cell disruption unit, R.S. Rohella, K.M. Swamy & S.K. Deb Roy—RRL, Bhubaneswar.



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Vacuum Measurement and Leak Detection : Symposium at NPL

A symposium on Vacuum Measurement and Leak Detection, organized by the National Physical Laboratory (NPL), New Delhi and the Indian Vacuum Society, was held at NPL on 6-7 March 1973. The participants were drawn from national laboratories, the Bhabha Atomic Research Centre, Indian Space Research Organization, Defence Laboratories, Indian Institute of Science, Bangalore, Indian Institutes of Technology, and universities and industries.

In his inaugural address, Prof. B. D. Nagchaudhuri, Scientific Adviser to the Minister of Defence, said that vacuum science which during the late thirties was regarded as an art has become a sophisticated technology today with its demand in space research, high energy accelerators and environments in fundamental research.

Dr A. R. Verma, Director, NPL, emphasized in his address the role which the National Physical Laboratory as the custodian of national standards can play in the accurate measurement of vacuum.

Delivering the key-note address, Shri C. Ambasankaran, Director, Electronics and Instrumentation Group, Bhabha Atomic Research Centre, Bombay pointed out how the ingenious idea of Bayard and Alpert who, by simply changing the order in a triode ionization gauge and replacing ion collector with a fine wire, made it possible to measure pressures as low as 10^{-12} torr and with a little modification to measure lunar space pressures of 10^{-15} torr. He said that just a decade back people were satis-

fied with 10-15% accuracy in measurements. He also emphasized the role which NPL could play in the calibration of gauges to the accuracy required by the present-day scientists.

Four technical sessions were held and about 20 contributed papers were presented.

The first session on vacuum measurements started with a review talk on vacuum standards by J.K.N. Sharma of NPL, who gave a comprehensive review of various standards being adopted internationally from atmospheric pressure down to 10^{-8} torr. Calibration and testing facilities developed at NPL for vacuum instruments were also dealt with. Notable among the contributed papers were those relating to strain gauges developed at NPL and to the sensitivity of indigenous BA gauge and residual gas mass analyzer developed at BARC.

The second session, devoted to leak detection in vacuum, started with a review talk on the various leak detection techniques by B. S. Prahallada Rao of BARC. Papers presented and discussed at this session were concerned with : indigenous thermal conductivity leak detector developed at NPL; use of ultrasonics in leak detection by P. Vijendran of BARC; experience in leak detection on Graf 35 mass spectrometer; and role of mass spectrometer in leak detection.

Papers dealing with the design aspects of vacuum system at ISRO and the performance of rotary vane and vacuum pumps (I.I.Sc., Bangalore) were presented at the third session.

In the fourth session, S. S. Ramamurthy of BARC gave a talk on the present state of vacuum instrumentation in India.

The panel discussion on the present state of vacuum instrumentation in India, which included participants from industry, research institutions and universities, was highly interesting. The participants felt highly satisfied with the role of BARC and NPL in the development of vacuum technology in the country. The general opinion was that more stress be laid by these institutions on developing the know-how for vacuum components and apparatus. The panel was of the opinion that users should insist on quality products and manufacturers must satisfy the requirement in accordance with IS specifications which are being finalized. It was stressed by various speakers that the calibration and testing facilities developed at NPL should be utilized by the manufacturers.

In his concluding remarks, Dr A. R. Verma said that NPL shoulders the responsibility to create and to maintain standards and will try to calibrate secondary standards of manufacturing companies. The laboratory, he said, is prepared for the time being to calibrate all vacuum equipments, for which facilities exist, until manufacturers acquire their own test set-ups.

CGCRI Develops Inorganic Bonded Built-up Mica

The know-how for the production of inorganic bonded built-up mica has been developed by the Central Glass & Ceramic Research Institute (CGCRI), Calcutta. A highly integrated composite insulating material built up from

Virulence of *Entamoeba histolytica* Causing Dysentery : Researches at CDRI, Lucknow

mica splittings and a specially prepared inorganic bonding material, the product is a versatile electrical insulating material approaching natural mica in mechanical strength and durability and is ideally suited for high temperature applications. It has the additional advantage of availability in large sheets at low cost or in single-piece full-size punchings.

Being completely inorganic it is smokeless and odourless, does not disintegrate or lose its mechanical strength in high temperature applications and can be used in various types of heating appliances for domestic and industrial uses. It satisfies all the electrical, thermal, insulating, mechanical and moisture-resistant qualities required under various conditions of operation, assembly and use. Because of its excellent abrasion resistance it is also highly suitable for applications in rotating apparatuses.

The material shows no oozing or slipping when subjected to high pressure and is extremely suitable for commutator applications at high temperatures where organic bonded micanite fails. The country's requirements of such types of insulating materials are presently met by import.

The product does not react chemically with resistor materials nor does it deteriorate when stored. It is unaffected by oils and organic solvents and exhibits high resistance to the action of water and water vapour. It may be easily punched, sawed, sheared or cut by standard tools used for sheet mica.

Because of its excellent mechanical, thermal and electrical characteristics it is highly recommended for use as a self-supporting carrier for heating coils, as mechanical and thermal washers and gaskets for high temperature applications, high temperature commutator segments, spacers and winding cards in toasters and heaters, thermal barriers, electromagnets and other high temperature applications.

The product developed at the institute is comparable to foreign products, and in respect of electrical properties it is better.

First described by a Russian physician F. Losch in 1875 in St Petersburg, amoebiasis has no effective cure. *Entamoeba histolytica* infection in temperate zone is generally asymptomatic. In the tropics, dysentery occurs frequently. According to Brumpt (1925), there are two morphologically indistinguishable strains. One is non-pathogenic and is responsible for infection in symptomless carriers in temperate zones. The other is pathogenic and is restricted to warm countries.

Since so little is known about the inherent pathogenicity of *E. histolytica* and its method of attack in the production of clinical amoebiasis that it is questioned whether the large number

of carrier cases in which there are no apparent symptoms of the disease should be treated for amoebic infection or not. It is well known that human infection with *E. histolytica* is associated with diarrhoea or dysentery or without any symptoms. Three hypotheses have been put forward to explain these differences. The first hypothesis supposes that *E. histolytica* is potentially virulent and the presence or absence of the symptoms is determined by varying degree of success of the host in combating the invasion of the intestinal mucosa. According to the second hypothesis there are two types of *E. histolytica*, one of which does not cause ulceration while the

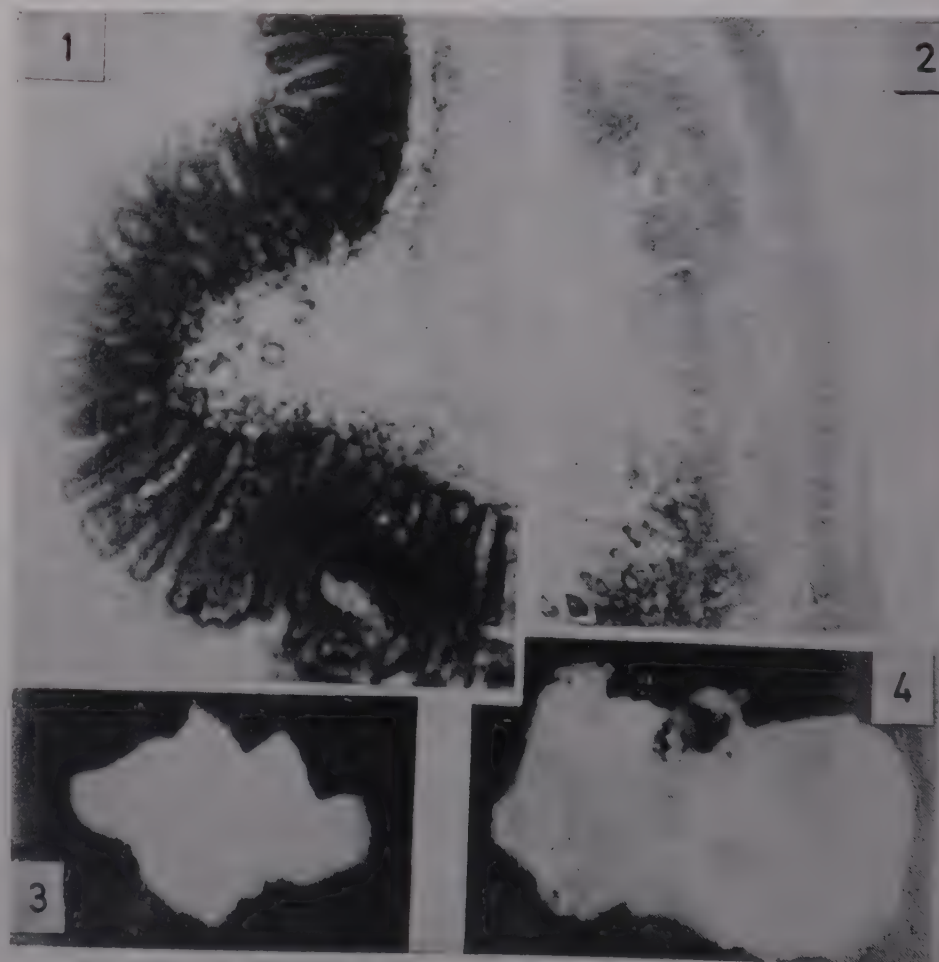


Fig. 1-4 : (1) Section of rat caecum infected with an avirulent strain of *E. histolytica*. The mucosal layer is intact and no marked change is noticed. (2) Section of rat caecum infected with an avirulent strain made virulent with cholesterol. Caecum shows complete necrosis of mucosa. (3) Caecum of rat infected with an avirulent strain. The appearance of the caecum is normal. (4) Caecum of rat infected with an avirulent strain made virulent with cholesterol. Extensive ulceration can be seen.

other is virulent and invades the tissue. The third hypothesis assumes that *E. histolytica* is essentially avirulent and participation of pathogenic bacteria is necessary before ulcers are produced. The main argument against the first hypothesis is the occurrence of the number of cysts and/or amoebae in the stools of carrier cases beyond those that can be calculated on the basis of amoebae escaping from small lesions. The other two hypotheses also do not hold.

Using young rats as experimental animals, it has been claimed by a few workers that strains of *E. histolytica* of the large race isolated in culture from acute cases of amoebic dysentery produce ulceration in the caeca, while those from symptomless carriers, with rare exceptions, are unable to invade the caecal wall and live as commensal. It has been concluded that rats react in the same way as human beings and the virulence of a strain is dependent upon the amoeba itself. In support of this finding they state that such factors as pathogenic bacteria, change in the diet of the host and encystation have no effect on the course of experimental amoebiasis. When a virulent strain becomes attenuated by prolonged *in vitro* cultivation, its virulence could be revived by hamster liver passage or rat caecal passage. These methods failed to increase the virulence of strains from carrier cases. A factor is said to be involved in the invasion of the large intestine by *E. histolytica*. This factor is possessed naturally by strains from acute cases and can be restored artificially. Avirulent strains do not possess this factor. Based on the above findings, it has been proposed that the large race of *E. histolytica* is composed of two stable races differing only in virulence.

Researches carried out at the Central Drug Research Institute (CDRI), Lucknow on the virulence of strains of *E. histolytica* of the large race, by developing a method for creating cent per cent infection in the caeca of young rats, have shown that strains

from acute cases are virulent. The strains from symptomless carriers may range from virulent to avirulent ones, the latter living as commensal in the caecal lumen. It has been discovered that non-virulent strains from carrier cases become virulent and produce extensive ulceration in the caeca of rats when the amoebae are fed cholesterol in culture (Fig. 1-4) or the rats are fed cholesterol before and after intra-caecal inoculation of avirulent amoebae. The acquired virulence of cholesterol-fed amoebae is gradually lost on prolonged *in vitro* cultivation without cholesterol. The virulence of these amoebae could again be revived by feeding amoebae with cholesterol. A non-virulent strain also became virulent to rats by hamster liver passage. Amoebae made virulent with cholesterol retained their virulence when they were maintained with cholesterol or by rat caecal passage. Thus,

cholesterol is one of the triggers which can change the erstwhile commensal amoeba into invasive form. A WHO publication is in agreement with this finding. The work of CDRI also supports the epidemiological data. If the virulent race of *E. histolytica* was confined only to the tropical or semi-tropical regions, it should have been introduced in temperate zones as during 1914-1918 and 1939-1945 wars there were worldwide movements of troops. Amoebic dysentery is still rare in temperate regions. Based on epidemiological consideration together with laboratory evidence by which virulence of *E. histolytica* can be modified, it may be stated that *E. histolytica* can change from virulent to avirulent state and *vice versa*. The nature of changes which occur when *E. histolytica* ceases to be a harmless lumen dweller and invades the mucosa is not fully understood.

PROGRESS REPORTS

NML Annual Report : 1971-72

The annual report of the National Metallurgical Laboratory (NML), Jamshedpur for 1971-72 shows that the research and development programmes of the laboratory continued to be oriented to the needs of mineral and metal industries both in the public and private sectors. One hundred and fifty-two projects in all were investigated; of these, 47 were sponsored projects and 105 were laboratory's own projects. Work on 59 projects was completed. The income of the laboratory during the year from the services rendered to the industry and to other research institutions amounted to about Rs 12.20 lakh.

A significant achievement of the laboratory was the commissioning of a prototype magnesium plant (capacity, 200 tonnes/annum) and commencement of successful trial runs. Production of tonnage quantities of low phosphorus steel from Indian pig iron in the basic-lined side-blown converter, developed at NML, was continued.

A two-step and a single step process have been developed on laboratory scale for chromium/chromium oxide deposition on steel substrate. The product has been exhaustively tested for flexibility, porosity and corrosion resistance, and found comparable with the imported tin-free steel (TFS). Consumer acceptability tests on TFS developed at the laboratory have been highly encouraging and it is planned to undertake in-plant trials to scale up TFS production.

Joint task forces have been constituted for tackling the following development projects at Rourkela & Durgapur Steel Plants and Tinplate Co. of India: (i) in-plant trials for aluminizing by NML process; (ii) in-plant trials of tin-free steel production; (iii) establishment of a 5 tonnes experimental L-D converter; and (iv) manufacture of low alloy high strength steels. Work on improving the service life of L-D converter lining at the Rourkela Steel Plant is also under way.

Hindustan Copper Ltd have appointed NML as their consultant for the

setting up and commissioning of 1000 tonnes per day concentrator plant at Rakha mines. The Calcutta Metropolitan Water and Sanitation Authority has assigned consultancy services to NML for providing cathodic protection to underground water mains. The operational efficiency of coinage production at Alipore Mint, Calcutta is being reviewed by NML at the instance of the Department of Economic Affairs of the Ministry of Finance.

The laboratory has been entrusted the task of testing raw materials for the projected steel plants at Salem, Vishakhapatnam and Vijayanagar. Kiriburu lumpy iron ores as well as fines after sintering have been evaluated in order to determine their suitability for use in the blast furnace of the Bokaro Steel Plant.

An economic flow sheet for optimum beneficiation of the Asswan iron ore has been evolved through batch and pilot plant studies, under a project sponsored by UNIDO. The concentrates were pelletized in both fluxed and unfluxed state and then subjected to prereduction using a highly volatile non-coking coal as solid reductant, when 85% average degree of metallization with 92.4% iron in the products were successfully smelted to produce pig iron.

The aluminium conductor (PM-52), developed at the laboratory, showed improved strength, electrical conductivity and ductility in the fully drawn condition. It compares favourably with the imported ones. Dry core communication cable has been successfully manufactured in association with a cable manufacturer. Tests carried out on dry core communication cables indicate that they could replace copper in many applications. The cable is now under extensive field trials conducted by NML in association with Telecommunication Research Centre, New Delhi.

A process for recovering nickel from rejected nickel plated strips has been developed. The process is very economical and does not entail the use of electric current. The base material can also be recovered undamaged.

An international workshop on Creation and Transfer of Metallurgical Know-how, organized by UNIDO, was held at NML in December 1971. The principal recommendations of the workshop are as follows: (1) Developing countries should achieve progressively increasing technical self-sufficiency. (2) Repetitive import of metallurgical know-how should be avoided and where technology is imported it should be improved upon and modified to indigenous conditions to develop local talent. (3) UNIDO should act as antenna in ensuring that the metallurgical know-how thus transferred leads to the development of technical consultancy services in the developing countries themselves.

Reduction of Cetane Number Requirement of High Speed Diesel Oil : IIP Scientists' Work Awarded

Sarvashri B.P. Pundir, P.D. Srivastava and P.K. Goel of the Indian Institute of Petroleum (IIP), Dehra Dun have won certificates of merit from the Indian Merchants' Chamber Diamond Jubilee Endowment Trust for their work leading to the reduction of cetane number (CN) requirement of high speed diesel oil from 45 to 42.

Three of the Indian Refineries (Barauni, Digboi and Gauhati) process mainly the Assam crude which is rich in aromatics. These refineries produce a distillate diesel fuel of poor

ignition quality, of a CN of about 40. To produce a diesel fuel of 45 CN as required by the earlier Indian Standard for high speed diesel fuel, the refineries had had to use large quantities of a cetane improver additive, Kerobrisol. The requirements of this additive to meet the IS specifications of high speed diesel fuel were imported and foreign exchange involved amounted to some Rs 36 lakh.

The institute took up investigations to find out whether a CN of 45 is essential for the automotive diesel engines operating in the country. The performance of the engines when fuels of CN lower than 45 are used was studied. The influence of CN on the combustion parameters (such as peak combustion pressures and rates of pressure rise), fuel economy, black smoke emission, engine wear and cold startability of the engines was studied. Some endurance trials were also conducted. On the basis of IIP's findings the concerned ISI committee decided that CN specifications of diesel fuel could be brought down to a 42 minimum from 45 minimum without any adverse effect on the engine performance and durability.

The adoption of the new IS cetane number specification of 42 minimum for high speed diesel fuel has resulted in over 90% reduction in the consumption of cetane improver by the Indian refineries. Consequently, a saving of about Rs 33.4 lakh in foreign exchange per year has been effected.

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

Anticorrosive Paint for Ships' Bottom

A process for making anticorrosive paints for use on ships' bottom, based on indigenous raw materials, has been developed by the Regional Research Laboratory (RRL), Hyderabad.

Paints used for application on ships' bottom are being produced indigenously using phenolic resins based on imported phenols. Most of the paints at present being manufactured by Indian

firms are reported to be unsatisfactory.

Data on the consumption of anticorrosive paints for ships' bottom in India are not available. Nevertheless, the data collected by the laboratory from three major shipping companies show that the annual consumption of such paint is about one lakh litres. However, with the continuing growth of shipbuilding industry, the demand for such paints is bound to increase several-fold.

The process developed by RRL, Hyderabad consists in preparing the medium first and then the paint. To a hot mixture of cashewnut shell liquid (CNSL) and hexamine are added white spirit and dehydrated castor oil (DCO) and the mass is heated. Styrene is then added to the mass, which is further heated. After cooling, the medium is stored in a tank. Required quantities of the medium, pigments and spirit are ground in a ball mill. Further quantities of the medium and white spirit are added to the ground mass and the mass is thoroughly mixed in a mixer. Aluminium pigment is then mixed with the mass. After the addition of driers the paint is filtered and packed in drums.

After carrying out the process on a laboratory scale, the laboratory prepared the paint on a pilot plant of 100 litres of paint per day (8 hr) capacity.

The product conforms to AC-655 standard specifications recommended by British Admiralty and also to IS : 1404-1963. The paint samples were successful in raft trials carried by the Naval Chemical and Metallurgical Laboratory, Bombay. The paint samples were also used as anticorrosive paint for structural steel in salty atmosphere by the Central Public Works Department at Bapatla. Service trials conducted on actual ship bottom by the Shipping Corporation of India for 13 months have shown that the performance of the paint is similar to that of the commercially available conventional primer.

The main raw materials are cashewnut shell liquid, dehydrated castor oil, hexamine, styrene, white spirit, pigments, and driers. All these are available indigenously.

The main items of equipment are stainless steel reaction vessel with stirrer and reflux condenser, ball mill, vertical mixer, storage tanks, handling equipment, and laboratory equipment. All these items of equipment are available indigenously.

The capacity suggested for a commercial plant is 450 tonnes of paint per annum (1 shift per day). For such a

unit the estimated land requirement is 25 000 ft² and the land needed for building is 5000 ft². The estimated outlay is Rs 9.05 lakh, comprising a sum of Rs 1.32 lakh on land and building, of Rs 2.81 lakh on plant and machinery, and a working capital of Rs 4.92 lakh. The cost of production as worked by the laboratory is Rs 6.12 per litre.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Optical Whitening Agents for Synthetic Fibre

Optical whiteners used for synthetic fibres are not manufactured in the country and are imported under various trade names (Mica White ATN). The demand for such whiteners is estimated at 20 tonnes per annum.

A four-step process for the manufacture of an optical whitening agent for synthetic fibre has been successfully developed by the National Chemical Laboratory (NCL), Poona. The raw material is sulphonated and oxidized to form an anhydride which is converted into the penultimate product and this is converted into the final compound which is purified to obtain the salable product. The work has been conducted on a laboratory scale and know-how has been standardized on 1 kg per batch scale. Trials using the product have testified to the suitability of the laboratory-prepared compound.

The major raw materials required are: acenaphthene, dichloroethane, chlorosulphonic acid, methanol, sodium hydroxide, aqueous methylamine, acetic acid and sodium dichromate. Of these, acenaphthene and methylamine will have to be imported initially. However, methylamine will soon be produced by the F.C.I., Trombay, and acenaphthene could be made available from coal-tar fraction of the Hindustan Steel Ltd, once a regular offtake is established. Other raw materials are available indigenously.

Sulphonation kettle, stainless steel kettle, reactor, wooden vats, and wooden Nutsche centrifuges are the important items of plant and machinery. All the equipment can be fabricated indigenously.

The laboratory has assumed a capacity of 5 tonnes of active ingredients per annum (which can be diluted four times to obtain the salable product) as the optimum capacity. The capital outlay for a plant of this size is estimated at about Rs 3.57 lakh (Rs 2.00 lakh on land, building and equipment, and Rs 1.57 lakh as working capital). The cost of production according to the process developed at NCL comes to Rs 88 per kg of finished product (naked) against the landed price of Rs 30 per kg for Mica White ATN formulation (20-25%), which on the basis of the percentage of active ingredient would work out to about Rs 120 per kg.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Chemical Polishing of Copper and its Alloys

Chemical polishing of copper and its alloys is done by employing an acid bath containing nitric acid, phosphoric acid and/or acetic acid with or without arsenic acid. This process however suffers from several drawbacks: it gives rise to abnoxious fumes; is costly; is sensitive to moisture; the polish has a short life; and the loss of metal during polishing is very high.

The process for chemical polishing of copper and its alloys developed by the Central Electrochemical Research Institute (CECRI), Karaikudi has several advantages. The process (Indian Pat. 101925) consists in treating copper and its alloys chemically in a solution containing alkali metal dichromate and sulphuric acid in suitable concentration with an organic inhibitor for 50-60 s at 30-80°C.

Advantages: This process is not sensitive to water and no drying is

necessary before polishing and hence is useful for continuous operation. This method does not require any post-treatment. No abnoxious fume is evolved during the treatment. Operating conditions such as temperature, concentration and treatment time are not critical. The electrolyte can be easily regenerated.

The process is suitable for polishing small articles of complicated shapes or with intricate embossed design which are not amenable to mechanical polishing.

Potassium dichromate, sulphuric acid and benzotriazole are the main raw materials needed. All are available indigenously.

The essential items of plant and machinery are: vapour degreasing tank, electrically heated drying chamber, polythene tanks, electrolyte tanks (lead-lined mild steel tanks), and silica immersion heaters.

A unit capable of polishing 100 sq ft per day of 8 hr in a bath of 40 litres volume has been estimated to cost Rs 60 000 (comprising a fixed capital of Rs 20 000 on building, of Rs 32 000 on plant, and a working capital of about Rs 8000). The cost of polishing one sq ft has been worked out at Rs 1.60.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

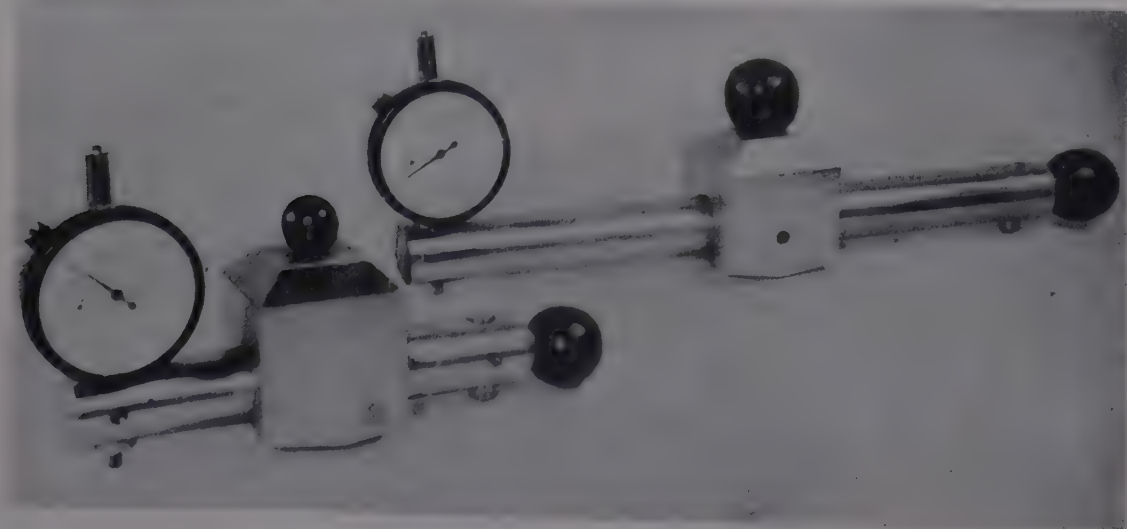
Beam Comparator

The beam comparator is a robust and reliable device for measuring flatness of precision machined surfaces in a short time. Its chief feature lies in its simplicity as it consists of a precision machined (cylindrical) beam with two supporting feet and a third foot formed by an indicating instrument, this being either at the middle or at one end of the beam. It is used for calibrating surface tables and large surfaces which have to be tested quickly. In other words, it takes the place of block levels and other flatness measuring devices. It is, however, to be calibrated against a precision block level over a length of truly flat surface before use.

A prototype has been designed and fabricated by the Central Mechanical Engineering Research Institute, Durgapur. Technical specifications of the device, of standard sizes of 125 and 250 mm length, with supporting feet fully hardened, are as follows:

Reading down to	0.002 mm
Net weight with gauge	1675 g; 2032 g
Flatness of calibrating block over calibrating length	within 0.0005 mm.

Precision calibrating block may be supplied with the instruments for adjusting the indicator to read a designed figure at the initial setting.



Beam comparator designed and fabricated by CMERI, Durgapur

Full-scale trials with the prototype unit were carried out at the institute and its performance was found satisfactory.

As the demand for the device is limited, it would be uneconomical to set up an independent unit for its manufacture. Any small manufacturer can take up the fabrication of the instrument and no special plant or machinery is required.

The cost of the instrument (including calibration block) has been estimated at Rs 300-350, while the cost of a similar imported unit without calibration block is about Rs 450 per unit.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Cadmium Sulphide Photo-conductive Cell

This is a light-sensitive device and is used for the detection and measurement of light. The cells have a variety of laboratory, industrial and commercial uses. In the laboratory, the device finds application in light measuring instruments like luxmeters and photo-colorimeters, turbidity meters, and automatic temperature controllers. In industry, its applications relate to liquid level controllers, industrial safety devices, and devices to indicate break in conveyor belt processes. Commercial uses extend to camera exposuremeters, twilight switches, and automatic door openers.

If devices of various types indicated above are made, the demand for these cells could be of the order of one million pieces per annum.

The National Physical Laboratory (NPL), New Delhi, has developed a large area cadmium sulphide photo-conductive cell. The process is as follows: Cadmium sulphide powder is doped with small quantities of suitable chemicals. The powder is then mixed with an organic binder and coated on a glass or a ceramic substrate. Several hundred substrates can be coated at a time by screen-printing technique.

CSIR SUPPORT TO RESEARCH

Completed Schemes

Analytical Studies on Tungsten

Various methods for the separation and determination of tungsten have been investigated under a CSIR research scheme functioning at the Department of Chemistry, Kurukshetra University, Kurukshetra. The studies were made by Shri A.K. Gautam, a CSIR research fellow, under the direction of Dr V. Yatirajam of the Department.

The methods are : (1) separation of tungsten as phosphotungstate ; (2) separation of tungsten as tungsten blue ; (3) extractive separation of tungsten by reduction with Zn-Hg ; and (4) extraction of tungsten by organic solvents after complexation with various organic reagents, viz. diethyl dithiocarbamate, dithiozone, dimethyl glyoxime, furildioxime, and α -benzoin oxime.

Of these, the first three methods were found promising and were studied in detail.

Extraction as phosphotungstate : To the solution containing a mixture of various elements including tungsten, a solution of Na_3PO_4 was added and the optimum ratio of W:P was fixed. The extraction of phosphotungstate was then tried at different acid concentrations and different acids, changing the solvents. A tungsten : phosphorus ratio in the range of 8-10 (w/w) at 3N HCl was found to be the most suitable. Of the various solvents tried, i.e. isoamyl alcohol, isoamyl acetate, methyl isobutyl ketone (MIBK), and ethyl acetate, MIBK was found to be the most suitable solvent for the extraction of phosphotungstate. Under these conditions more than 99% of tungsten is extracted but not completely and some of other elements like Mo(VI) and Fe(III, II) were coextracted. This problem was solved to some extent by reduction with ascorbic acid when W(VI) remains unchanged and other elements are reduced as follows : Fe(III) \rightarrow Fe(II), V(V) \rightarrow V(IV), Cr(VI) \rightarrow Cr(III). Cobalt and nickel were not reduced and could not be extracted in their

normal oxidation states. Attempts were made to suppress the extraction of molybdenum and iron but this could be achieved at the cost of extraction of tungsten. Thus the system was found suitable for the analysis of tungsten in its alloys with low molybdenum and iron.

Extraction as tungsten blue : Reduction of W(VI) was tried with various reducing agents such as hydrazine sulphate, dithionite, liquid metal amalgams and mercury. Tungsten(VI) was found to be very stable. Metallic reductants such as tin or zinc reduce W(VI) solution to blue precipitate. Precipitation can however be avoided by keeping W(VI) in solution by the use of phosphate, acetate, or oxalate. For extraction purposes only phosphate was useful, since others suppress the extraction to a considerable degree. Metallic reductants were unfavourable since these metals when in solution get extracted under the conditions of extraction of tungsten. Pure mercury was found suitable for the reduction of phosphotungstate in HCl medium at concentrations of about 3N. Tungsten and phosphorus were adjusted to a ratio of 4(w/w), and W(VI) was then reduced by shaking with mercury. Tungsten blue was formed, and other elements were reduced to lower valency states which are unfavourable for their extraction [Fe(III) \rightarrow Fe(II), V(V) \rightarrow V(II), Cr(VI) \rightarrow Cr(III)]. Tungsten blue in solution was shaken with isoamyl alcohol and more than 99% of tungsten was extracted. Attempts to separate tungsten from molybdenum were only partially successful. Tungsten could be separated from low amounts of Co(II), Ni(II), Fe(III), Fe(II), V(V) and Cr(III).

Reduction of tungsten with zinc amalgam and extraction of reduced species with acetylacetone : Tungsten was reduced in concentrated HCl medium by Zn-amalgam to W(III) which forms a complex with acetylacetone. Tungsten(VI) was reduced to W(III) (yellow), which when shaken with

After the coating has dried, it is sintered at 500-700°C in a furnace in an inert atmosphere. Contacts are applied to the cadmium sulphide with the help of silver paint. The electrodes are taken out by soldering two wires to the substrates. The piece thus prepared can be encapsulated in a plastic box or in an evacuated glass envelope.

The cells, which have maximum sensitivity to visible light, have the following characteristics :

Light-to-dark current ratio	: about 10^3
Rise time	: in μs
Decay time	: in μs
Power dissipation	: up to 300 mW.

These large area, sintered cadmium sulphide photo-cells are cheap and could compete in the market with selenium cells, cadmium sulphide single crystal cells and photo-diodes. At least 100 times more sensitive than the cells of other materials the cadmium photo-cells are sensitive to much lower light intensities and operate over a wider temperature range. Compared to the cadmium sulphide single crystal cells, these cells are much cheaper, and can handle larger power. They do not need any amplifier circuit to operate relays.

The main raw material is photo-conductivity grade cadmium sulphide powder. This is available from NPL.

The main items of equipment are : controlled atmosphere electric furnace, screen-printing equipment, encapsulating equipment and testing equipment. All these are available indigenously.

For a unit capable of producing 25 000 photo-cells per year the total investment required (excluding cost of land and building) is Rs 97 500 (Rs 60 000 on plant and equipment, and Rs 37 500 as working capital).

The cost of production per cell has been estimated by the laboratory to be Rs 6 for the plastic encapsulated cell and Rs 9 for glass encapsulated cell.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

acetylacetone led to more than 50% extraction. With repeated extractions more than 80% recovery was obtained. Most of the interfering elements were reduced, i.e. $\text{Cr(VI)} \rightarrow \text{Cr(II)}$, $\text{V(V)} \rightarrow \text{V(II)}$, $\text{Fe(III)} \rightarrow \text{Fe(II)}$, $\text{Cu(II)} \rightarrow \text{Cu(I)}$, $\text{Mo(VI)} \rightarrow \text{Mo(III)}$, and were not extracted. But the disadvantage of this method is the incomplete extraction of tungsten even after repeated attempts which cause the extraction of interfering elements in traces.

Extraction of tungsten was tried after complexation with many organic reagents and then by shaking with immiscible organic solvents. In most of the cases, W(VI) does not form any complex as, in acidic medium, it gets precipitated as tungstic acid. In some cases, where tungsten in lower oxidation state forms complexes, many interfering elements are extracted.

Extraction of tungsten as thiocyanate complex was studied in its normal and lower valence states. In this method, most of the interfering elements formed thiocyanate complexes even after reduction. Reduction of W(VI) was possible only in high acid concentration and at these acid concentrations thiocyanate complex of molybdenum was also extractable.

Morphology of Ionospheric F2-Layer

Under a CSIR research scheme which functioned at the Department of Physics, Gujarat University, Ahmedabad, Miss N. K. Parikh, a CSIR research fellow, undertook a study of normal and disturbed-day diurnal variations of the critical frequencies f_oF_2 of the F2-layer at magnetically conjugate places in the east, far east, European and the west zones. The studies were carried out under the direction of Dr K. M. Kotadia of the Department. Some typical examples of severe magnetic storms commencing at different local times were studied to find latitudinal effect of the storm. From the extensive study one definite conclusion has emerged: the storm effects in low and equatorial latitudes are primarily controlled by the electrodynamic drift of F2 ionization and at midlatitudes the

role of neutral wind-induced vertical drift is significant. The dependence of the daytime maximum of f_oF_2 on magnetic declination is also seen at midlatitudes.

The seasonal variations of noon and midnight f_oF_2 were studied at conjugate places over a range of latitudes in three different longitudinal sectors for high and low sunspot activity periods. The north-south symmetry found in these variations could be partly explained by the difference in zenith distance of the sun at a place and partly in terms of the local magnetic field variations.

PATENTS ACCEPTED

Indian Pat. 133676

Strain gauge flow transducer
V. R. Singh & R. Parshad
NPL, New Delhi

The patent under reference relates to the development of a strain gauge flow transducer for measuring the flow rate of fluids. The transducer consists of two chambers, viz. fluid chamber and the gauge chamber, and the two chambers are separated by a leak-tight steel diaphragm. The diaphragm facing the gauge chamber is eccentrically mounted on a silicon strain gauge connected to a Wheatstone bridge and a high gain dc amplifier. By means of inlet and outlet tubes connected to the flow chamber a fluid is made to flow through the fluid chamber. A fraction of the pressure causing the flow is exerted on the steel diaphragm, which slightly sags under this pressure, thus causing an elastic shear strain to the silicon gauge, whose attendant change of electrical resistance is monitored by the electrical recording system. Thus the output of the electrical system becomes an index of the flow rate. Quantitatively, the square of the flow rate is proportional to the electrical output.

In concept, this flow transducer is different from the usual obstruction type flow rate transducers in which the deflection of the obstruction placed directly in the path of the flow measures the flow by means of the strain

gauge mounted on the obstruction or otherwise. If the pressure causing the flow is small, the obstruction will tend to alter the very flow which is required to be measured. This defect is overcome in the present flow rate transducer.

PATENTS FILED

747/72: Improvements in or relating to production of composite nickel for sintered matrices used in alkaline storage batteries, H. V. K. Udupa, P.V.V. Rao & Prema Rangorath—CECRI, Karaikudi.

1587/72: A process for treating textile materials to impart durable press properties, V. B. Chipalkatti, N. B. Sattur, I. Hussain & R.C. Gupta—SRIFIR, Delhi.

1615/72: Improvements in or relating to the production of oil well cement, S.N. Dutta, T. Seshadri, B.C. Jana, T.C. Saikia & M.S. Iyengar—RRL, Jorhat.

1616/72: A process relating to the production of benzonitrile from toluene, a constituent of coke oven benzol and petroleum naphtha, S.K. Ray, S.C. Ray, G.S. Murty, H.S. Rao & A. Lahiri—CFRI, Dhanbad.

1812/72: A process relating to the production of terephthalodinitrile from *p*-xylene, a constituent of coke oven benzol and petroleum naphtha, S.K. Ray, S.C. Ray, N.V.R. Appa Rao, H.S. Rao & A. Lahiri—CFRI, Dhanbad.

PATENTS SEALED

126179: An improved method of constructing bored compaction piles, K.G.S. Jain, M.P. Jain & C. Prakash—CBRI, Roorkee.

126709: Improvements in or relating to the preparation of iron catalysts for hydrogenation of coal, D. K. Mukherjee, P. B. Chowdhury, J. K. Sama, A.N. Basu, N.G. Basak & A. Lahiri—CFRI, Dhabad.

126770: A process for the recovery of silver and gelatin from the waste, processed and/or unexposed photographic films, plates, papers, cine films and X-ray films or plates, S. P. Srivastava, (Mrs) S. Laxmi, P.V. Krishna & M.S. Iyengar—RRL, Jorhat.



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Corner Stone of NIO Buildings Laid

Shri V. V. Giri, President of India, laid the corner stone of the laboratory buildings of the National Institute of Oceanography (NIO), Panaji on 7 April 1973.

In his address, the President expressed the hope that this oceanographic complex would play an important role in the national life. He commended the role of CSIR in fostering the Indian participation in the International Indian Ocean Expedition and consolidating the efforts of this period in the form of NIO. He was also appreciative of the fact that important programmes were under way in Goa, Cochin and Bombay, and commended the way men and their work took precedence over buildings.

In the context of modern developments, the President said, the ocean was recognized as a treasure-house of raw materials, both living and non-living, and that an over-populated country like India is bound to look to the ocean for the animal protein and minerals to augment the insufficient supplies on land. He expressed satisfaction for the pioneering efforts made in the country since independence which secured marine resources a high place in our national economy both as a source of high quality food supply and as an earner of valuable foreign exchange. The expansion of marine fisheries would widen the scope of employment opportunities, he added.

The President felt that the mineral resources of the Indian seas, excepting the atomic mineral sands of the Kerala coast, had hardly been tapped. Stating

that a beginning had already been made in the Gulf of Cambay, he hoped that several lakhs of square miles of the Indian continental shelf could legitimately be expected to contain minerals of high value and petroleum reserves.

In his brief address, Shri S. K. Banerjee, Lt Governor of Goa, Daman and Diu, stated that the location of NIO in this territory was very appropriate in the light of Goa's connections with the sea from time immemorial. Though the institute serves the whole country, Goa would particularly profit greatly from the institute's studies on fishery resources and preservation of the navigability of the rivers which are a vital link for the export of iron ore, and should become equally valuable routes for tourists in future, he said.

In her address, Shrimati Sumati Morarjee, chairman of the executive council of NIO, emphasized the practical utility of marine science in navigation, shipping, naval and civil activities, and especially in relation to food, mineral and oil resources. She traced the genesis of the institute and referred to its objectives. Referring to the studies on the fishery potential of Goa and hydrological studies of Bombay waters for sewage waste disposal, carried out by NIO on specific requests from the Government of Goa and the Bombay Municipal Corporation, she mentioned that the value of the services of the institute had been increasingly realized by the public and requests were being received from private agencies for taking up spon-

sored projects relating to the coastal and estuarine pollution problems. Continuing, she said that India has a growing programme in the field of marine sciences, including efforts for exploiting offshore fisheries, petroleum and minerals, and the institute is to develop fast to undertake and fulfil the national programme in oceanography, to train scientific personnel, to build up self-reliance and to be of service to the nation in many ways.

Earlier, Dr N. K. Panikkar, Director, NIO, described in his welcome address briefly the importance of India's marine resources, including fisheries, minerals and petroleum in the seas around a 5000-km coastline of the Indian sub-continent and hundreds of oceanic islands. He also referred to the important role played by oceans in shaping the Indian climate, particularly the onset and duration of monsoon, and said that the institute is devoted to studies of oceanic resources and properties in the broadest sense. Dr Panikkar said that research was under way at the headquarters of the Institute in Goa, and the regional centres at Cochin and Bombay. He expressed the hope that similar centres would be established in Waltair and Calcutta. When completed, the institute will be one of the largest of its kind in Asia.

CFTRI Assists in Launching Intensive Industrial Campaign in Mysore District

A team of scientists from the Central Food Technological Research Institute (CFTRI), Mysore participated in an intensive industrial campaign organized by the Industries and Commerce Department of the Government of Mysore

in Mysore District from 5 to 13 March 1973. The object of the campaign was to encourage the development of industries in Mysore District, declared as one of the industrially most backward districts in the state. In this campaign the concerned Central and State Government departments, financial institutions, associations of small scale industries, and CFTRI collaborated in carrying the message of the potential of industrial development in the district keeping in view the raw materials available and fiscal and other concessions offered by the State and Central Governments for setting up industrial units in backward districts. The CFTRI scientists' team visited, along with the representatives of other organizations, different taluks of the district and assisted in educating the public by giving the required information for setting up food industries. The team assisted in drawing up plans for 16 entrepreneurs in setting up food industries in different taluks.

Chemical Studies on Amoebic Encystment

Chronic amoebiasis claiming a 20% world endemicity is associated with the refractoriness of the cystic form of amoebae to known drugs. The imperative need to elucidate the factors inducing encystation of amoeba has, therefore, been rightly stressed by the WHO expert group on amoebiasis. As part of a project aimed at the chemotherapy of amoebiasis, the Central Drug Research Institute, Lucknow has been studying the molecular biology of amoebic encystment. Using auxinically grown *Hartmannella culbertsoni* as a model it has been possible to bring about encystation in a well-defined medium by taurine, epinephrine, tyramine or dopamine. The process involves gene transcription and hence the synthesis of new species of RNA coding for the enzymes that mediate the manufacture of cellulose and mucopolysaccharide used for structuring the cyst wall. The bioamines trigger the process of encystation through the second messenger agency of cyclic

AMP by first binding to the membranes of the amoeba and activating a membrane-bound adenylyl cyclase. Reserve polysaccharides such as glycogen are degraded and the glucose released is utilized for synthesis of cellulose. Encystation is also accompanied by the appearance of new serological characters.

Science and Technology of Sponge Iron and its Conversion to Steel : Symposium at NML

An international symposium on Science and Technology of Sponge Iron and its Conversion to Steel was held at the National Metallurgical Laboratory (NML), Jamshedpur from 19 to 21 February 1973. Thirty delegates from Australia, Austria, Bulgaria, Egypt, France, West Germany, Hungary, Iraq, Japan, Nepal, Norway, Thailand, UK and USA and more than 250 engineers, metallurgists and executives representing various research and industrial establishments in India participated in the symposium. Besides the inaugural session, there were five technical sessions devoted to : (1) Sponge iron—Fundamental aspects, present status and future developments; (2) Fundamental and operational aspects of sponge iron production in rotary kilns; (3) Gaseous reduction of iron ore to sponge, and submerged arc furnace smelting; (4) Steelmaking with sponge iron; and (5) Pre-reduced burden in pig iron production and pre-reduction in shaft furnace.

Forty-four papers dealing with the fundamental and applied aspects of direct reduction by solid and gaseous reductants and the conversion of sponge iron to steel by the basic oxygen process and in ultra-high power electric steelmaking furnace were presented and discussed. Of these, 21 papers were contributed by overseas delegates. The symposium was inaugurated by Shri Kedar Pandey, Chief Minister of Bihar.

In his keynote address at the inaugural session, Prof. V. A. Altekar, Director, NML, stated that the conventional steelmaking process is not technically or economically feasible in certain localities. He drew attention to the

A major part of this work was carried out by Shri Mohan Kumar Raizada, of the Central Drug Research Institute—under the direction of Dr C. R. Krishna Murti. Shri Raizada has been awarded the Ph.D. degree (1973) by the Kanpur University for his thesis relating to the studies.

Science and Technology of Sponge Iron and its Conversion to Steel : Symposium at NML

heavy capital investment required for the installation of new steel plants adopting the conventional techniques. Sponge iron could play an important role in iron- and steel-making technology in the future.

Brief accounts of some of the papers presented at the various sessions follow.

Sponge Iron—Fundamental Aspects, Present Status and Future Developments

In his key-note address, M. N. Dastur (Dastur & Company, Calcutta) stated that the direct reduction process is well suited to Indian raw materials and would pave the way for the setting up of direct reduction electric steelmaking plants in the different regions of the country to meet the local steel demands for light products.

Kohji Kamiya and coworkers (Japan) discussed in their paper (presented by Shintaro Tabata) the mechanism of desulphurization of iron ore pellets mixed with coke during reduction and concluded that a considerable part of sulphur was removed in the gaseous state as sulphur dioxide below the firing temperature of 1000°C.

M. W. Salem (Egyptian Iron & Steel Co., Cairo) discussed the reducibility of Asswan ore and sinters of varying basicity ratios. The ore was found to be more reducible than fluxed sinters. The reducibility of fluxed sinters improved with increase in basicity.

Discussing the kinetics of reduction of iron oxides and ores with carbon, M.C. Abraham and A. Ghosh (Indian Institute of Technology, Kanpur) concluded that the kinetics of the gasifica-

tion reaction controls the overall rate of reduction of iron oxide.

The characteristics of non-coking coals from the point of view of the suitability of such coals for use in the production of sponge iron was the subject of a paper presented by S. Bagchi and coworkers of the Central Fuel Research Institute, Dhanbad.

Fundamental and Operational Aspects of Sponge Iron Production in Rotary Kilns

In his key-note address, Kurt Meyer (LURGI, West Germany) discussed the present status of the SL/RN process and the possibilities of its adoption in India.

In their paper entitled 'Operational aspects of sponge iron production in a rotary kiln', B. L. Sengupta, A. B. Chatterjea, G. P. Mathur and V. A. Altekar (NML) presented the results of extensive trials undertaken at NML to ascertain the possibility of exploitation of different grades of iron ores and non-coking coals. Trials with lumpy ores and green or heat-hardened pellets yielded adequate techno-economic data needed for designing a commercial prototype or for industrial production of sponge iron.

Some fundamental aspects of operational parameters of direct production in a rotary kiln were stressed by A. B. Chatterjea (NML). It was pointed out that the rotary kiln would be an excellent means for direct reduction of iron oxides provided difficulties like dust generation, temperature fluctuation and ring formation are overcome through proper control of the process parameters.

Gaseous Reduction of Iron Ore to Sponge, and Submerged Arc Furnace Smelting

H.D. Pantke (Thyssen Purofer GmbH, West Germany) described, in his key-note address, the Purofer process of direct reduction of iron ore using reformed natural gas in a vertical shaft furnace. The designing of a plant of 1000 tonnes per day capacity based on Purofer process was also reported.

The use of naphtha vapour without prior reformation for direct reduction of iron ore, leading to a high degree of metallization, was reported by V.A. Altekar and coworkers (NML). The setting up of direct reduction plants near Mangalore, Goa or Paradip ports based on imported naphtha was suggested.

Steelmaking with Sponge Iron

Discussing the present state of development of steelmaking with sponge iron, J. Astier (IRSID, Maizières-les-Metz, France) described the iceberg technique developed at IRSID. According to him, the electric arc furnaces of the future would be based on the use of prepared burden, such as pre-reduced raw materials, and probably some prepared special scraps.

Jack Robert Miller (Columbus, Ohio) projected the future worldwide demands of metallized iron ore for steelmaking: 11 million tonnes (MT) in 1975, 64 MT in 1980 and 124 MT in 1985. He also emphasized that electric steelmaking would progressively gain importance with increase in the use of pre-reduced material.

Scope and Development of Small Industries in Orissa Region : Seminar at RRL, Bhubaneswar

As part of the celebrations in connection with the silver jubilee of India's independence, the Regional Research Laboratory (RRL), Bhubaneswar organized a seminar on the scope and development of small and medium scale industries in the Orissa region on 24 February 1973. The seminar was inaugurated by Shri Banka Behary Das, Minister of Finance, Planning and Coordination, Government of Orissa, who in his address stressed the need for developing a modern but intermediate technology which will utilize abundant manpower, local talent and indigenous raw materials. He assured the laboratory of the cooperation of the Government of Orissa to further the activities of the laboratory in this direction. In his welcome address, Prof. P. K. Jena, the Director, outlined the scope and functions of the labora-

Pre-reduced Burden in Pig Iron Production and Pre-reduction in Shaft Furnaces

That the use of pre-reduced pellets reduces capital investment in steel plants was the conclusion of a paper presented by U. N. Bhrany of IISCO.

In their paper entitled 'Sponge iron production in a vertical shaft furnace', A. B. Chatterjea, T. C. De and V. A. Altekar (NML) stressed the main advantage of the vertical shaft furnace, viz. higher output per unit volume, in comparison with a rotary kiln.

In his paper entitled 'Technical and economic evaluation of alternative routes to steel', Adolfo Antonioli (University of Rome) held that coal should meet all thermal requirements, while hydrocarbons should be used for gas generation for reduction purposes.

In the panel discussion held at the conclusion of the technical sessions, there was unanimity that the technology of sponge iron should be adopted as a supplement to the blast furnace technology, particularly in developing countries engaged in the expansion of iron and steel industry.

tory and its role in the establishment and development of small and medium scale industries in the region based on local raw materials.

The deliberations of the seminar were held in two sessions: technical session, and panel discussion. In the technical session, 12 papers relating to engineering, minerals, metals, chemical industry, and marine and agro-based industries were presented.

In the panel discussion, a number of industrialists, scientists and entrepreneurs discussed how to develop small and medium scale industries in the region, the bottlenecks involved and measures to be adopted to bring about rapid progress in this direction. For accelerating the growth of industries, it was suggested that stress should be laid on the training of personnel, adoption of modern management techni-

ques, selection of appropriate technology, provision of assistance by way of loans and incentives on tariff, etc., location of industries on a technical bias, creation of necessary infrastruc-

ture (both social and economic), critical examination of market conditions by specialists, and creation of a project development authority in each state.

PROGRESS REPORTS

CDRI Annual Report : 1971

The annual report of the Central Drug Research Institute (CDRI), Lucknow for 1971 records the steady progress the institute has made in its eleven long-term projects. The total financial inputs during the year amounted to about Rs 6.632 million, comprising a recurring expenditure of about Rs 5.653 million and a capital expenditure of about Rs 0.979 million.

A new intra-vaginal contraceptive device, named Centsquare, has been developed. It consists essentially of a thin film of carboxy methyl cellulose in which urea is incorporated as spermicide. The device is simple in use, can be produced very cheaply from indigenous raw materials, is free from side effects, is readily acceptable, and has a very low rate of failure compared to other currently used methods of contraception. In field trials extending for about 1400 woman months the degree of protection afforded by the device was more than 90%.

Clinical pharmacology studies were completed on Centchroman, a potential oral, post-coital, antifertility agent synthesized earlier. It appears to be safe for contraceptive efficacy trials for which the permission of the Drug Controller (India) was awaited.

For prophylactic management of bleeding episodes following insertion of an IUCD, adrosem salicylate has been found effective as revealed by tests on female rhesus monkeys. Encouraging results were also obtained in women in limited trials.

Processes for the production of nicotinic acid and nicotinamide were standardized. Processes for the preparation of 3-amino-2-phenylpyrazoline, an intermediate in the production of sulpha-

phenazole and of chloropropamide, were worked out on a laboratory scale.

Micrococcus glutamicus, mutated by ultraviolet irradiation, has been found to give a good yield of L-lysine when grown in a simple synthetic medium. The same organism could also produce glutamic acid under different growth conditions. A commercial process for the production of these amino acids was under development.

An antibiotic isolated from the mycelium of a soil actinomycete was found active against *Staphylococcus aureus* in a dilution of 1 : 25 million. It also caused reduction of tumour in rats up to 82% at 1 mg/dose.

A strain of the fungus *Aspergillus flavus* has been found to yield an antiviral substance which protects mice against Semliki forest virus infection.

Centazolone, a new tranquillo-sedative, has passed successfully through single-dose tolerance tests in phase I clinical pharmacology studies. It was found safe up to a dose of 160 mg compared to an expected clinical dose of 10-20 mg.

Pharmacological investigations on a promising synthetic anti-inflammatory agent were completed. The compound was found to be much less gastro-ulcerogenic than indomethacin, a currently used anti-inflammatory drug, and was free from analgesic and antipyretic effects.

Two hundred and eighty-five extracts and 312 new synthetic compounds were screened for pharmacological activities. Anticancer activity *in vivo* was confirmed in four plants; as many showed interesting pharmacological activities. Of the synthetic compounds, 3 showed antifilarial activity, another 3 *in vivo* antiamebic activity and 4 anticancer activity.

Detailed pharmacological and toxicological evaluation of curcumin, an anti-inflammatory constituent of *Curcuma longa*, has been completed. The compound has been found safe for pre-clinical studies.

From *Mappia foetida*, two alkaloids, viz. camptothecin and methoxycamptothecin, have been isolated and the anticancer constituent of *Nicotiana plumbaginifolia* was identified as β -D-glucosyl- β -L-rhamnosyl solasodine.

The structures of the alkaloids mahanine methyl ether and murrayacine from *Murraya koenigii*, coronarine and voacangine from *Ervatamia coronaria* and isococlaurine from *Cocculus pendulus* have been elucidated.

A single low dose of diethylcarbamazine has been found to induce migration of at least 75% of the microfilariae from the lungs to the peripheral blood where they are not normally found during day time. This can facilitate diagnosis of filariasis by using blood samples taken during the day instead of at night.

Cyclic AMP incorporated into non-nutrient agar medium has been found to mimic the action of magnesium ions and taurine in bringing about transformation of atrophic forms of *Hartmannella culbertsoni* into mature viable cysts. Such encystation was prevented by actinomycin D or cycloheximide. Synthesis of cyclic AMP by amoebae, undergoing encystment, was found to increase 3- to 4-fold by incorporation of magnesium ions and taurine in the non-nutrient agar medium.

Genetic recombination has been observed between a strain of non-cholera vibrio and four strains of *Vibrio cholerae* as a result of chromosomal transfer from the former to the latter. The hybrids appear to retain all the parental characters of *V. cholerae* except for a change in the locus O of the genetic region which appears to code for the synthesis of O antigens of non-cholera vibrio. This study opens up the possibility of using such hybrid strains for the evaluation of effective components for cholera immunity.

One hundred and twenty-three research papers and review articles were

published and five patents were filed during the year.

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

Xanthotoxin

Xanthotoxin (ammoidin) is an established remedy for leucoderma. It is also used extensively in 'Suntan' lotions in European countries. At present no indigenous production of xanthotoxin is reported and the entire requirement (valued at Rs 3-4 lakh per annum) is met by imports. There is considerable export potential also for this drug.

The Regional Research Laboratory (RRL), Jammu has developed a process for the manufacture of xanthotoxin from *Ammi majus* seeds. The mixture of coumarins obtained from the seeds is converted into xanthotoxol, which on methylation gives xanthotoxin. The laboratory investigations have been conducted on 500 kg lots of seed. The yields at different stages of the reaction have been worked out. The yield of xanthotoxin on seed weight basis is 0.4%. The product obtained in the laboratory is a pale yellow crystalline odourless powder of mp 146-8°C, of moisture not more than 1%, of negligible ash content, and assays to not less than 96% (dry basis). The product has been sold to some firms in Bombay who have reported that it is satisfactory.

A. majus seeds, *n*-hexane, ethyl acetate, solvents, dimethyl sulphate, alumina, silica gel, and activated carbon are the main raw materials required for the manufacture of xanthotoxin. All these are available indigenously.

Extractors, boiler, pulverizer, stainless steel containers, and solvent storage tanks are the major items of plant and machinery, and these can be easily fabricated by any engineering firm in the country.

The laboratory has suggested 50 kg per annum of the final product as the optimum size capacity of the plant. The total capital outlay for a plant of this size is estimated at Rs 4.21 lakh

(fixed capital on building, plant, etc. of Rs 2.96 lakh and a working capital of Rs 1.25 lakh). The cost of production of the product comes to Rs 4750 per kg against a price of Rs 9000/kg being quoted in the market.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Line Voltage Regulator

Fluctuation of line voltage occurs almost in all electrical systems. Such fluctuation leads not only to the deterioration of its performance, but sometimes damages vital components. To test the performance of electrical appliances constant voltage is essentially required,

and in such cases a constant voltage regulator unit is always preferred. This requirement is generally being met by a saturable type constant voltage transformer. The main disadvantage with such a type of transformer is that the power at loads should be always above 50% of the rated value of such a transformer, otherwise the constant voltage transformer gets heated up in continuous use and ultimately fails. The other disadvantage is that output voltage wave formed usually gets distorted with reduced load. The third disadvantage is that the output voltage cannot be set to other values easily. Hence the need for developing other types of regulator.

The Central Mechanical Engineering Research Institute (CMERI), Durgapur, has developed a line voltage regulator. The regulator functions with a motor which rotates an auto-transformer, moving contact according to the error with respect to set voltage to compensate any change in the load voltage. The primary of a double-wound auxiliary transformer is connected to the output of the auto-transformer. The secondary of this transformer is connected in series with the load. Therefore, when the supply voltage falls below normal, an electrical relay operates to provide proper contact for energizing the motor which then moves the auto-transformer brush in the required direction to compensate the voltage at the load side. Similarly, when the voltage increases, the motor moves in the opposite direction to inject voltage in the load side in the opposite phase. The CMERI unit can supply loads up to 10 kV but the same control unit can be used for any capacity of the regulator.

The capacity of the regulator can be increased only by increasing the rated capacity of the auto-transformer which handles only 20% of the full rated power of the load; it keeps output voltage within 1% of the line voltage. The output voltage can also be set at any value from 100 to 250 V. But this can also be widely changed if the auxiliary transformer is suitably designed to provide different tappings.



Line voltage regulator developed by CMERI, Durgapur

The specifications of the regulator developed by CMERI are as follows :

Output	: 10 kVA
Input	: 180-250 V
Output	: 230 V (adjustable to any value between 180 and 250 V)
Frequency	: 50 c/s
Output volts accuracy	: $\pm 1\%$ for any combination of line voltage or frequency, load or power factor
Power factor	: 0 to 1 leading or lagging
Response time	: 10 c/s + 1 c/V
Distortion	: None added

The demand for such regulators (of different capacities), estimated at 1000 units per year, is met by conventional type saturated constant voltage transformer.

A prototype of 10 kVA unit was fabricated and tested for electrical characteristics. It is now under use.

A general type of workshop can undertake production of this unit. No special type of machineries are required.

The components required for the manufacture of the regulator include : auto-transformer (capacity, 20% of load), double-wound transformer, reversible small geared motor which is available indigenously (single or double phase), ac voltmeter, and control unit consisting of two relays, transformer, transistors and resistors.

The cost of the prototype unit is Rs 1500 and the market price would be Rs 2500 per unit.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Lithium Carbonate and Lithium Fluoride from Lepidolite

Lithium chemicals are extensively used in the country and the entire requirement is at present being met by imports. As lithium chemicals are not listed separately in the import statistics, precise information regarding their import is not available.

The major use of lithium chemicals is at present in the form of lithium hydroxide monohydrate for the manufacture of special greases for aviation and industrial uses, and the demand is estimated at about 100 tonnes per annum. Another important lithium chemical is lithium chloride for making welding electrodes and is imported to the extent of about 10 tonnes per annum. Substantial amounts of lithium carbonate and fluoride are also imported for use in ceramics, glasses, glazes and enamels.

Lithium carbonate being the starting material for other lithium chemicals, investigations were undertaken at the Central Glass & Ceramic Research Institute (CGCRI), Calcutta, and a process has been developed for the production of lithium carbonate from lepidolite or lithium mica, which is the only lithium-bearing mineral available in the country. Lithium fluoride, another important lithium chemical, is obtained as a byproduct of this process.

Optimum conditions for the production of technical grade lithium carbonate and fluoride have been worked out on a laboratory scale and utilization aspects of the process have also been studied.

The process consists, in brief, of the following steps : (i) sintering of lepidolite mixed with other reactive substances; (ii) leaching of the lithium salts from the gangue; (iii) separation of most of the lithium in the form of lithium carbonate; and (iv) recovery of residual lithium in the form of lithium fluoride.

Lepidolite, the major raw material, and the other materials used in the process are available in plenty in the country. According to the mine owners of Rajasthan and Bihar there are large deposits of lepidolite for which there is no market. According to the Atomic Energy Department the available reserves down to only shallow depths would be of the order of 10 000 tonnes. No precise assessment of the reserve of lepidolite has, however, been made.

The major items of plant and equipment are : jaw crusher, hammer mill, pulverizer, batch mixer, pelletizing machine, filter press, evaporator, centrifuge, blunger, sintering furnace, and drying chamber. All these can be fabricated indigenously.

For the production of 10 kg of lithium carbonate per day the total capital outlay has been estimated at Rs 1 23 000 (Rs 1 03 000 on plant and equipment, and Rs 20 000 as working capital). The cost of production of lithium carbonate is estimated at Rs 31.50 per kg as against Rs 100 per kg being quoted in the market.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Pentaerythritol

Pentaerythritol is an important organic intermediate used in the manufacture of synthetic resins and the explosive pentaerythritol tetranitrate. Though at present some firms are producing this chemical in the country, large quantities are still being imported. The import of pentaerythritol during 1970-71 amounted to about 1750 tonnes, valued at Rs 69.78 lakh. With more supplies, the demand for the chemical is expected to increase at its annual growth rate of 10-15% (for the last 5-8 years). About 85% of pentaerythritol consumption is by synthetic resins industry. The rest goes into the manufacture of pentaerythritol tetranitrate.

The Regional Research Laboratory (RRL), Hyderabad, has developed a process for the production of pentaerythritol using raw materials and equipment available in the country.

The process consists in reacting solutions of acetaldehyde and sodium hydroxide with a solution of formaldehyde in a stainless steel reactor under controlled and programmed temperature conditions. The reaction products are concentrated in an evaporator and pentaerythritol is crystallized out in a crystallizer. The number of crystalli-

zations required depends on the purity of the product desired. Finally, pentaerythritol is dried in a drier. Sodium formate is obtained as a byproduct.

The work was carried out on a laboratory scale and also scaled up to a 6 kg per batch unit. The yields were 78-82% on the basis of acetaldehyde. The product obtained in a typical run contained: monopentaerythritol, 95%; dipentaerythritol, 4.5%; and ash, moisture, etc., 0.5%. The product compared well with the imported samples.

The raw materials required are formaldehyde, acetaldehyde, caustic soda, and formic acid. All the raw materials are available indigenously.

The plant and machinery required are: stainless steel (SS) reaction kettle with condenser, SS evaporator with external heat exchanger, SS receiving tank and crystallizer, SS centrifuge, electric or steam drier, SS ion-exchange columns, vacuum assembly, SS centrifugal pumps, and storage and transportation tanks. All these are available indigenously.

For a plant producing one tonne of pentaerythritol per day (3 shifts) the total investment, as estimated by the laboratory, is Rs 26.634 lakh (comprising a sum of Rs 2.134 lakh on land and building, Rs 14.500 lakh on plant and machinery, and Rs 10.000 lakh as working capital). The cost of production has been estimated at Rs 11 620 per tonne.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

PATENTS ACCEPTED

Indian Pat. 126708

Method of electroplating a heat flow meter
K. N. Agarwal, V. V. Verma & K. R. Rao
CBRI, Roorkee

This invention relates to a process of manufacturing heat flow meters by electroplating copper ions on a constantan wire wound on a non-conducting plate of bakelite or similar materials. Electroplating is done by dipping

half portion of the constantan wire in copper sulphate. The constantan wire of 36 SWG is wound on the nonconducting plate by a coil winding machine. The electroplated plate is enclosed in a guard ring. Electrical connections are provided at the ends of the constantan wire. The whole assembly is treated with a thin paste of Araldite and sandwiched between a pair of backing plates.

The heat flow meter produced by this method is as sensitive as the imported counterpart and the unit is very cheap compared to the imported one. The process has several advantages: (1) The raw materials used are indigenously available; (2) the heat flow meter can be produced in different sizes as required in any specific application; (3) an effective guard ring is provided in each unit; and (4) its calibration factor varies from 10.0 to 30.0 kcal hr⁻¹ m⁻² per mV, which is sensitive enough for most practical problems.

The instrument can be used for the measurement of heat flow through walls and roofs of buildings, furnaces, drying rooms and cold storages. Its use in the measurement of thermal properties of insulating materials is widely accepted. It will also find extensive application for the measurement of heat flow in geophysical problems, ground water investigations, refrigeration and air-conditioning industry.

Indian Pat. 129423

Foetal heart rate monitor
S.K. Mangal & R.S. Khandpur
CSIO, Chandigarh

The invention relates to a heart rate monitor for measuring the heart beat of unborn children from the twelfth week of pregnancy onwards. The methods in vogue for determining the foetal heart rate involve the recording of foetal ECG by suitably placed electrodes on the mother's abdomen and recording the combined maternal and foetal ECG. The foetal QRS complex is so small as it tends to be obscured by maternal ECG and interference, etc. that it is extremely difficult to automatically extract a defined

foetal ECG pulse in order to display foetal heart rate. Similar disadvantages limit the use of phonocardiography for monitoring foetal heart rate. The conventional foetal stethoscope also gives limited information because the beats of the foetal heart are to be counted over a particular period and the information about the variations in foetal heart frequency cannot be detected during these relatively short periods.

The patent relates to a device developed for monitoring foetal heart rate using ultrasonic Doppler's shift principle and a new technique of photoelectric demodulator. A transducer consisting of two crystals, one for transmitting and the other for receiving reflected signals from moving blood particles from the foetal heart, is placed on the abdomen of the pregnant woman. The received signal which is shifted in frequency from the transmitted signal is electronically processed to yield pulses corresponding to the foetal heart beats. These pulses can then be shaped and integrated to give a display of foetal heart frequency on a calibrated meter.

The device is particularly useful for monitoring the foetal heart beat during early pregnancy. It offers a quick and the only reliable method for display of the integrated heart rate of both the mother and the unborn child. A battery-operated and portable instrument, it is free from possible electric shock hazards and ground leakage currents occurring in the mains-operated devices.

Indian Pat. 129424

Photoelectric demodulator
S.K. Mangal & R.S. Khandpur
CSIO, Chandigarh

The invention relates to a demodulator for the detection of a low frequency modulating signal from a modulated signal. The usually known amplitude modulated demodulators essentially employ a diode and capacitor network. These are applicable when the carrier frequency is very high as compared to the modulating signal, otherwise the ripple content in

the signal detected becomes significant. The patent describes a demodulator which works on photoelectric principle and gives ripple-free demodulated signal. The demodulator consists of a photo-sensitive device placed in front of a lamp. The lamp is connected to the modulated signal and ripple-free demodulated signal is obtained through the photo-sensitive device. The device is particularly useful when the modulated signal contains multiple carrier frequencies.

This device has been especially developed for use in the foetal heart rate monitor developed by CSIO (Indian Pat. 129423).

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122504: A composition which on being burnt will give off smoke for repelling, immobilizing, paralyzing, or causing death to flying insects such as mosquitoes, S. Prasad & K.R. Jamwal—RRL, Jammu.

Obituary

Shri R. Jayaraman

It is with deep regret that we record the passing away of Shri R. Jayaraman, Scientist-in-charge, Indian National Oceanographic Data Centre of the National Institute of Oceanography, Panaji on 16 March 1973 in New Delhi.

Born on 6 August 1919, in Madras, Shri Jayaraman had a brilliant academic career at the Madras University and started his career as a research worker in the Chemistry/Biochemistry Laboratories, Madras. He held various positions as chemist and biochemist during 1940-47. His interests during this period were enzymes, microbiology, vitamins of the liver of elasmobranch fishes and related areas.

In 1947 he joined the Central Marine Fisheries Research Institute and continued his research work till 1962 on a variety of subjects relating to hydrology and fishery oceanography of the waters along the coast of India.

Shri Jayaraman was one of the first few scientists who joined the Indian Directorate of the International Indian Ocean Expedition (IIOE) in 1962 and was in charge of planning and data and general administration. He played a significant role in planning the programmes carried out during IIOE on behalf of India. He was one of the pioneers of systematic oceanographic research in India. He played a considerable part in organizing the Chemical Oceanography Division of the institute. He was also the editor of the quarterly bulletin *Mahasagar*, published by NIO.

Correction

In the progress report relating to the CSIR research scheme "Genetic Basis of Nitrogen Fixation and Cellular Differentiation in Blue-Green Alga" published in *CSIR News*, 23 (1973), 57, the last sentence of the first para should be read as:

The studies were made by Shri D.N. Tiwari, a CSIR research fellow, under the direction of Prof. R. N. Singh, at the Department of Botany, BHU, Varanasi.



CSIR NEWS

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Fifth Technological Conference of IJIRA

The fifth technological conference organized by the Indian Jute Industries' Research Association (IJIRA), Calcutta, was held in Calcutta on 6-7 March 1973. The conference was inaugurated by Shri S. N. Chakravartee, Jute Commissioner, Government of India, who in his address urged the jute industry to reduce the cost of jute manufactures through technological improvement to meet the rising competition from synthetics and other substitutes in the traditional uses of jute and said that the work should also be supplemented by a policy of diversification aimed at higher output of sophisticated items. New uses with existing facilities had to be found out as substitute for the declining demand in traditional product lines. It was only by maintaining technological leadership, he observed, that the industry could recapture its leading position in the world market. He expected that IJIRA would spearhead this activity with all the support from the industry both in matters of finance and practical utilization of research results.

The transactions were spread over four sessions and included three papers and three study group reports dealing with the two most important themes, viz. cost reduction, and quality improvement of jute manufactures.

In the paper entitled 'Some effects of moisture on the jute yarn properties', D. Gupta, New Central Jute Mills Co. Ltd, presented the results of investigation carried out in this mill on optimization of moisture addition through emulsion application to

achieve reduced wastage, higher productivity and improved quality. The extent of moisture loss at different processing stages was also observed. Some optimum range of moisture application was found for different seasons to enable retention of optimum regain in the sliver spun into yarn. The author pointed out that the investigation had to be pursued because the hot dry season was not covered and also because of the enormity of variations of factors obtaining in the industry, which affect moisture loss during processing.

Moisture deficiency in jute goods, particularly during dry seasons, causes heavy financial losses to the industry. Efforts have been made to overcome this difficulty through the use of humectants. I. B. Chakravarti and P. K. Pal described in their paper the results of studies leading to the identification of suitable humectants and the development of a technique for their application on jute. It was found possible to retain a minimum of 2-3% additional moisture over the normal by the application of about 1% of the humectants without adverse effects. A net saving of Rs 50 to 60 per tonne of jute was reported.

The work of the study group on 'Effect of batch composition and fibre preparation on yarn properties' was concerned with the application of the IJIRA fibre upgrading process by the use of suitable cationic surfactants and/or biological cultures. The group covered fresh ground and concentrated on the relatively less profitable areas

of hessian and sacking warps. The finding is that a very substantial portion of the superior and costlier White and Tossa in the normal batches could be replaced by corresponding quantity of suitably upgraded cheaper mesta fibre and/or cuttings, resulting in savings of the order of Rs 1.25 per maund in hessian warp and Rs 2.55 per maund in sacking warp, without impairing the quality and productivity.

Attainment of higher machine productivity to reduce the cost of manufacture was the theme of the study group report on 'Higher productivity at the yarn preparatory stages'. It was concluded that productivity could be raised through higher load at the carding and higher speed at the drawing stages, provided there was strict observance of a regular maintenance and overhauling schedule.

The study group on 'Improved sizing practices' confirmed the previous finding that the optimum tamarind kernel powder (TKP) add-on for jute sizing should be in the region 3.0-3.5% on the weight of warp yarn. Studies on the utilization of a few size additives in size composition showed only marginal improvement in the weavability of sized yarn. On the basis of the results obtained the group pointed out that jute sizing formulation could be simplified. Only TKP (3-3.5%) and a suitable antiseptic in adequate dose can form the basis of an economic size formulation.

In the paper entitled 'A pragmatic approach to quality assurance of jute goods', B. L. Banerjee described quantitatively the dimensions of variability in product quality occurring under normal working conditions and dis-

cussed the effect of factors causing the variability. Because of the high variations obtaining in the quality parameters, mills usually over-engineer their goods with higher input in order to minimize the risk of rejection at inspection with the consequent increase in the cost of manufacture.

Fabric quality was shown to be related to the characteristics of corresponding yarns and loom parameters. Based on the results the author considered a shift in emphasis from finished goods inspection to in-process checking and control followed by a general check against any major deviation of product quality as a pragmatic approach for quality assurance of jute goods.

500-Channel Data Logging System

The National Aeronautical Laboratory, Bangalore has designed and fabricated a 500-channel data logging system for the Structural Engineering Research Centre (Regional), Madras.

The system is proposed to be used in several projects of national importance like containment vessels for atomic reactors, high voltage transmission towers and grain storage silo models. Similar systems can be used on any structural model, for example in fatigue testing of aircraft. It also finds application in industrial process control.

The system accepts analog signals from the strain gauge bridges (mount-

ed on actual models) and converts them to digital equivalent. The digitized output is converted into a suitable computer-compatible code (in this case IBM 1620 computer) and the data are punched on a paper tape.

The system can scan at a maximum rate of 10 channels per second and provides flexibility in scanning any required number of channels. The system provides input for strain gauge bridges in different configuration (half bridge, half bridge with common dummy, and full bridge configurations). The output is directly readable in microinches/inch and the accuracy is ± 4 microinches/inch, or $\pm 0.5\%$ of reading. Complete logic of the system is built using integrated circuits.

The entire system was built at a cost of Rs 4.25 lakh. The cost of imported components used in the system, including the paper tape punch, is less than 5% of the total cost.

Roof Support in Mines using Scrap Haulage Rope

A new method of roof support in mines has been developed by the Central Mining Research Station, Dhanbad, making use of scrap haulage rope. The method has been found to be very successful and more effective than the conventional wooden supports. The cost of support by this method was about half of the cost of wooden cross bars. The method has been tried on a large scale in four mines where roof conditions were unsatisfactory. About 3 km length of the galleries in these mines were supported by the new method.

Old haulage rope of 22 or 19 mm diam. and 5-6 m length (depending on the width of gallery) is used to replace wooden cross bars. The two ends of the rope are grouted in 1.5-m deep holes drilled in the roof at 45° angle and about 0.6 m away from the rib so that the anchorage extends over the solid pillars. A special method of grouting the ropes which does not require any special equipment has been developed. The ropes are tensioned against the roof with wooden sleepers. Tests have indicated that each rope can take a minimum of 10 tonnes load.

Cable Fault Locator

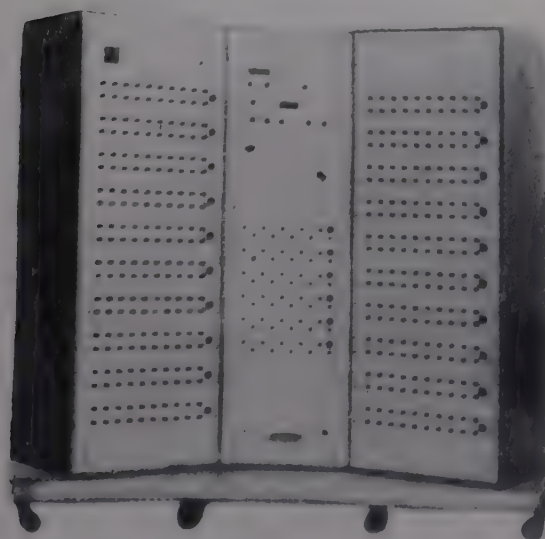
The Central Mining Research Station (CMRS), Dhanbad, has developed and patented a cable fault locator (Indian Pat. 113745). Available to entrepreneurs for commercial exploitation, the instrument is used to locate the exact position of short-circuit faults inside multicore cables such as trailing cables, drill cables and armoured cables used in mining and other industries. Very often, faults develop in cables supplying power to portable and transportable machineries because of the severe duty and rough use they are subjected to. The device can also locate earth faults involving insulated cores and earth conductors or protective metallic screen or armouring in a cable. A modified version of the instrument, also fabricated at CMRS, can locate both short-circuit and open-circuit faults in trailing cables.

The device consists of a pickup probe, an amplifier and an indicating meter housed inside a compact and portable cabinet. It can be fabricated entirely from indigenously available components and at a reasonable cost.

Symposium on Fluid Power Control and Applications

A symposium on Fluid Power Control and Applications was held on 12-13 February 1973 at the National Aeronautical Laboratory (NAL), Bangalore under the joint auspices of the Indian Institute of Science (IISc), Bangalore, and NAL.

Eighty-three delegates representing 26 establishments in India, who are actively involved in the study and practice of oil hydraulics, pneumatics and fluidics, participated in the symposium. The programme of the symposium, held in four sessions, consisted



500-Channel data logging system designed and developed by NAL, Bangalore

of nine lectures, two technical visits and two film shows. The papers covered a spectrum of studies starting from fundamentals through applications to the state of art.

In the first session, P. Dransfield of the Monash University, Australia (Visiting Professor at IISc), reviewed in his first paper the structure and position of fluid power control and automation technology along with the fundamental phenomena which govern the behaviour of fluid power devices, application of system dynamics from design requirement and utility points of view. In his second paper, Dransfield dealt with some areas of current research and development in fluid power. Salient design features that determine the performance characteristics of axial piston pumps and motors were dealt with in one of the papers presented at this session.

In the second session, V. Srinivas (Aeronautical Development Establishment, Bangalore) outlined the method of applications of fluidic systems for jet engine control, while Sridharandhas [Space Science and Technology Centre (SSTC), Trivandrum] covered the role of pneumatic and hydraulic control components for aerospace applications and gave an account of some of these components developed at SSTC.

The third session included four papers. In his paper, B. Balakrishna (NAL) covered the applications of electrohydraulic feedback control systems in research and development in aeronautics. A. R. Vasudevan (Hindustan Aeronautics Ltd, Bangalore) surveyed the application of hydraulics to aircraft and some problem areas which the industry is presently facing. U. R. Acharya (Veljan Hydrair Private Ltd, Hyderabad) dealt with some special pneumatic circuits for machine tools and other industrial applications. B. G. Suryanarayana (NAL) explained the different hydraulic systems of the 4-ft trisonic wind tunnel of NAL.

The fourth session discussed various aspects of fluid power in relation to its present status in the country and invited suggestions for accelerating the pace and progress of this technology in the country.

After the scheduled session proceedings, the participants held independent discussions and unanimously decided that symposia of this kind should be held regularly to promote the growth of this technology through coordinated efforts. It was also decided to form a 'Fluid Power Society' in India.

progress was made in the design and construction of pulsed transient airborne electromagnetic system.

Three maps giving probabilistic seismicity in the Indian subcontinent were prepared. A composite Bouguer anomaly map of Punjab and Haryana was also prepared. Gravity studies in Himalayas indicate the prevalence of isostatic equilibrium in the Kumaon-Garhwal part of Uttar Pradesh Himalayas.

The electromagnetic (EM) laboratory has been equipped to undertake studies on a wide range of variable parameters. EM model studies carried out during the year include the electromagnetic response profiles over the conducting models of spherical and sheet type shapes.

Detailed analytic studies relating to the time-domain electromagnetic interactions with conductive geologic structures have been carried out with emphasis on (i) inhomogeneous conductivity distribution; (ii) non-uniform primary excitation; (iii) differing shapes of the input pulse; (iv) presence of conducting surroundings; and (v) non-zero permeability contrast of the ore deposits.

Geochemical analysis of samples of Dharwar metavolcanics indicate that the chemical composition of Dharwar metavolcanic suite from Chitradurga is similar to that of early Pre-Cambrian meta-basalts of the Canadian and Australian shields.

Resistivity profiling with two-electrode array shows that as far as the conducting vein-shaped targets are concerned, the simplest unfocussed two-electrode array has advantages over Wenner, Schlumberger, modified unipole and focussed surface laterlog systems.

Geothermal logging has been carried out in boreholes at North Karanpura, Jharia and East Bokaro Coalfields. Paleomagnetic studies were undertaken on a sample from Lonar lake (Maharashtra) and Sagar (Madhya Pradesh).

Investigations for ground-water were undertaken on sponsored basis in different areas of Andhra Pradesh: Dugginavalli village (Nalgonda dist.);

PROGRESS REPORTS

NGRI Annual Report: 1971-72

Preparation of a composite Bouguer anomaly map comprising Iran, Afghanistan, Pakistan, India, Nepal, Burma and Sri Lanka, and setting up of a tritium laboratory to undertake geohydrological studies are among the major achievements of the National Geophysical Research Institute (NGRI), Hyderabad, as revealed in its annual report for 1971-72 published recently. The financial inputs in 1971-72 amounted to Rs 4.127 million, comprising a capital investment of Rs 1.332 million and a recurring investment of Rs 2.795 million.

Airborne magnetic and scintillometric surveys were carried out over the

eastern part of the Narbada valley in Madhya Pradesh, involving about 20 000 line kilometres of production flying. The entire proton magnetometer system employed in the survey was designed and constructed in the institute. A torroidal sensing probe was used to give dependable signal even for off-position orientations of the probe in flight. An aerodynamically stable probe-housing (bird) and necessary tow-cable pay-out/retrieval mechanism were designed and constructed for carrying out the survey.

The design of rubidium vapour magnetometer was modified so that it could be used for ground and airborne magnetometric surveys. Considerable

Kakinada Port railway station; and around Motukuru Reservoir forest area. Experimental geophysical measurements at Kolar for locating ancient gold working has been completed. Geological and geophysical investigations were carried out across Cheyyeru river (near Rajampet) and Kalyani river (near Tirupati) for examining the foundation conditions at the dam alignments selected by the Public Works Department.

A report on the study of the phenomenon of 'equatorial electrojet' has been prepared based on work carried out in collaboration with the India Meteorological Department and survey of India. Collaborative activities are proposed to be extended to the fields of ground-water management, deep seismic sounding and Deccan flood basalts with West Germany, USSR and USA respectively. The institute has initiated studies under the International Geodynamics Project.

The batch production unit of the institute produced and sold geophysical instruments worth Rs 1.37 lakh. The cost of instruments produced is one-third the cost of their imported counterparts while reliability and accuracy are comparable.

Forty-one research papers and 12 technical reports were published during the year.

CPHERI Annual Report: 1972

One hundred and fifty projects including 35 sponsored ones were investigated in 1972 by the Central Public Health Engineering Research Institute (CPHERI), Nagpur and its zonal laboratories, according to its annual report for 1972 published recently. Work on 45 projects was completed during the year.

Apart as its regional reference centre for air pollution, WHO has designated CIPHERI as a regional reference centre on community water supply and waste management. A new field laboratory was set up at Baroda to carry out investigations on the treatment and disposal of industrial wastes in the region. A field laboratory was also set

up at Panvel to study the air pollution levels in CIDCO (City and Industrial Development Corporation of Maharashtra Ltd), Bombay.

A flowsheet for economic treatment of pulp and paper mill wastes was developed. A full scale anaerobic lagoon of 80 million gallons capacity is being developed to treat 4 million gallons of wastes per day at the Orient Paper Mills (Madhya Pradesh).

Studies on the denitrification of nitrified wastes were carried out using a synthetic waste containing potassium nitrate and methanol which served as a source of carbon. Two reactors, one consisting of a pebble bed and another of a granulated coal, were found suitable for removing 98% of the nitrate.

A flowsheet for the removal of the phenol and formaldehyde contents of wastes from laminate factories was worked out. Another for the treatment of tannery wastes was developed; a demonstration unit is being set up in a tannery in Tamil Nadu.

Work on coagulant aids was continued and the results were utilized in running full-scale water treatment plants. The synthetic coagulant aid CA-3, developed at the institute, was found suitable for treating waters with a turbidity content of more than 300 units. The effective dose was found to be 2-10 mg/litre in pH 2-9, and this could bring about 40-55% savings in the consumption of alum, the coagulant normally used. A synthetic anionic coagulant aid, CA-15, was developed and its performance was found satisfactory.

At the request of the Bombay Municipal Corporation, the institute conducted and completed investigations for augmenting the water supply and improving the sewerage system in Greater Bombay, and submitted reports containing recommendations. At the request of the Jammu & Kashmir Public Health Engineering Department, the institute conducted a survey of the performance of water treatment plants at Srinagar and assessed the quality of the Dal lake and Jhelum river waters. Recommendations for

improving the performance of the water treatment plants and sanitary quality of the raw water sources were made.

A pilot plant using Defluoron-2 as the medium was set up at the Central Training Institute, Hyderabad to treat 25 000 gal of water of high fluorides content.

Design criteria for the use of oxidation ditch under Indian conditions have been developed. A pilot biological disc having 50 discs of 8 ft diam. was set up and operational data for the plant at different loadings are being collected.

At the request of the Calcutta Metropolitan Development Authority, a study of the rational methods of disposal of refuse from Howrah City was carried out and a report detailing proper methods of refuse collection during next 25 years was submitted.

A synthetic medium for bacteriological analysis of water was developed; its performance is being tested in other laboratories in comparison with McConkey broth.

Studies on the removal of bacterial pathogens and enteric viruses from sewage by different methods of treatment were continued. A pilot oxidation ditch with a sludge retention time of 6-12 days and solids concentration of 2000-4000 mg/litre brought about more than 99% reduction in the virus content in raw sewage, as against 90-95% in a conventional activated sludge unit. A simple and elegant method of enumerating enteroviruses in sewage and sewage effluents has been developed.

At the instance of the Central Power Research Institute, Bangalore, a survey of hydrogen sulphide pollution in three hydel projects, viz. Sabarigiri, Kundah and Bhadra, was made, and a report suggesting remedial measures was submitted.

A survey of Karimnagar district in Andhra Pradesh was conducted to assess the scope of development in public health sector as part of the CSIR project to transform rural areas through the application of science and technology.

PHYSICAL RESEARCH COMMITTEE : PROGRESS OF RESEARCH—1972

One hundred and six research schemes were in progress under the purview of the Physical Research Committee in December 1972. Seven new schemes were sanctioned and 35 schemes were terminated during the year.

A survey of 50 schemes selected at random from those which were active throughout the year showed that about 25% of the schemes were on solid state physics and crystallography, 10% on spectroscopy, 10% on developmental work, 10% on theoretical physics, and 45% on miscellaneous subjects. A meeting of the research committee was held on 24 April 1972. One hundred and thirty research papers were published.

Brief accounts of the research schemes which have yielded significant results follow.

Two devices for the crystallite orientation study of fibres by means of X-rays have been fabricated. One of them is for taking orientation pictures of fibres with X-rays and the other is for radial micro-photomentering of the photographs.

The orientation of crystallites in *munj* fibres as obtained in nature as well as of the fibres treated with caustic soda of varying concentrations has been determined at room temperature following the method of Hermans and Hermans. Orientation was found to vary from 0.90 to 0.94.—(Physics Department, University of Allahabad, Allahabad).

A reverberation technique for ultrasonic absorption work in the kilohertz region and at a temperature range of 25-60°C has been developed. About 20 organic liquids have been studied in the frequency range 100 to 1200 kHz and from 25 to 60°C. Relaxation effects have been observed in some cases and were analyzed thoroughly; for the rest of the liquids the temperature coefficient of absorption and velocity have been determined. A liquid mixture and some electrolyte solutions were also

studied by this technique.—(Physics Department, Nizam College, Hyderabad).

A modified angular force model which takes into account the effect of the presence of conduction electrons on the lattice vibrations on the basis of Sharma and Joshi model along with the ion-ion central (up to third neighbour) and de Launay type angular interaction (up to second neighbour) was considered. The three BBC transition metals, viz. alpha iron, molybdenum and tungsten, were investigated. A calculation for phonon dispersion relations, Debye θ and Debye-Waller factor reveals a good agreement with the experimental data (wherever available) in all the cases.—(Physics Department, IIT, New Delhi).

A new technique using tetrad formalism for perturbation of cosmological models has been developed. It directly gives differential equations for the growth of shear, density and rotation. The growth of density perturbations both in isotropic and anisotropic models has been computed.

Gravitational instability of an anisotropic dust-filled universe was briefly considered. It has been shown that the rate of growth of density perturbations in an anisotropic model is faster in the early stages of expansion as compared to Friedmann models; however, this is not fast enough to account for the growth of observable inhomogeneities if the initial perturbations are assumed to be of the order of statistical fluctuations. — (Mathematics Department, University of Gorakhpur, Gorakhpur).

A generalized formulation has been worked out for the evaluation of configurational energies of isolated defects and defect pairs, which includes an improved treatment of the relaxation of ions nearest to the defects. The energies of association between vacancy pairs and divalent cation impurity vacancy pairs in the first three associated states of KCl have been calculated.

Interaction energies of cation-anion vacancy pairs and divalent cation impurity-vacancy pairs in cesium halides have been evaluated by means of ionic lattice calculations with a rigorous treatment of the relaxation of ions in the vicinity of defects. The binding energy of first associated valency pair is lower than the coulombic value. The binding energies of the divalent cation impurity vacancy pair vary in the order: third, fourth, second and first associated state. The energy of the second bound pair was close to the coulombic value.—(Chemistry Department, IIT, Kanpur).

Uranium concentration in feldspar, pyroxene and carbonate groups of minerals has been studied by using the induced fission track technique. Fractions of homogeneously and heterogeneously distributed uranium have been estimated by differential counting. The suitability of the minerals for fission track geochronology was also studied.—(Physics Department, Kurukshetra University, Kurukshetra).

Raman spectra of hexagonal layer compounds MoS_2 , MoSe_2 and MoTe_2 were excited by a He-Ne laser (6328 Å). All the Raman-active long wavelength phonon frequencies were determined. These are A_{1g} , E_{1g}^1 , E_{1g} and E_{2g}^2 . The frequencies decrease as we pass from sulphur to tellurium and the quasi-acoustical mode E_{2g}^2 has the lowest frequency. A comparison of the results with infrared spectra shows that the IR-active modes for E perpendicular to C is degenerate with one of the Raman-active modes in the basal plane for all the compounds.—(Physics Department, IIT, Delhi).

The optical phonons in the single crystal of $(\text{NH}_4)_2\text{SO}_4$ have been studied under different geometries at room and low temperature with 4880 Å Ar-ion excitation. Evidence has been obtained for an asymmetric double minimum potential for the motion of protons undergoing strong H-bonding at low temperatures.—(Physics Department, IIT, Kanpur).

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

Sorbitol and Mannitol from Cane Sugar

Sorbitol is a basic raw material used for the manufacture of vitamin C. Sorbitol syrup finds use in moisture conditioning and improving the quality of cosmetic creams and lotions, tooth paste, tobacco, gelatine and glue specialities; as bodying agent for paper, textiles and liquid pharmaceuticals such as elixir, and syrup; as softener for confections; and in the synthesis of certain resins, surface-active agents and additives.

Mannitol is obtained as byproduct during the production of sorbitol and finds extensive use in medicine and explosives, in the manufacture of synthetic resins and in fermentation industry. Since the sorbitol obtained by this process is contaminated with mannitol it is not suitable for the production of vitamin C.

The exact demand pattern of sorbitol and mannitol is not available, but it is expected that because of their extensive end uses, the demand for both these will go up considerably. At present Sarabhai M. Chemical Pvt. Ltd have established a production capacity of 600 tonnes per annum of sorbitol. They are producing mannitol also, though on a small scale. The imports of sorbitol in 1968-69 and 1970-71 were 326 tonnes and 86 tonnes, valued at about Rs 6 lakh and Rs 1.36 lakh respectively. Imports of mannitol in 1969-70 and 1970-71 were 45.6 tonnes and 8.2 tonnes, valued at about Rs 4 lakh and Rs 91 000 respectively.

The National Chemical Laboratory (NCL), Poona, has developed a process for the manufacture of sorbitol starting from cane sugar. Mannitol is obtained as a byproduct. The process consists of catalytic reduction of invert sugar. The work was initially done on a laboratory scale, 250 g of sugar per batch, which was scaled up later to 5 kg of sugar per batch. The products obtained by

this process were tested in the laboratory and found to be comparable to the commercial samples.

Sugar, catalyst, caustic soda, filter aid, and ethyl alcohol are the major raw materials required for the preparation of mannitol and sorbitol. Except the catalyst, all raw materials are available indigenously. The plant and equipment required can be fabricated indigenously.

For a plant capable of producing 300 tonnes (251.25 tonnes of sorbitol which is equivalent to 359 tonnes of 70% sorbitol normally used, and rest mannitol) the capital outlay is estimated at Rs 21 lakh (Rs 14 lakh on building, plant and machinery and Rs 7 lakh as working capital). The ex-factory cost of the naked product comes to Rs 3.85 per kg of sorbitol and Rs 15.45 per kg of mannitol.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Sorbitol from Dextrose Monohydrate

A process has been developed by the National Chemical Laboratory (NCL), Poona for the preparation of 70% sorbitol. The process consists in hydrogenating dextrose monohydrate in solution at a pressure of about 200 psi. Sorbitol solution thus obtained is deionized, decolorized and concentrated. Based on the laboratory work, pilot plant trials up to a scale of 75 kg per batch of dextrose monohydrate have been successfully carried out. The product has been tested by the Hindustan Antibiotics Ltd for the production of vitamin C and found to be suitable.

Dextrose monohydrate, Raney catalyst, caustic soda and activated carbon are the major raw materials required for the production of sorbitol. Except Raney catalyst, all the raw materials

are available indigenously. The plant and equipment for the process can be indigenously fabricated.

The total capital outlay for a plant capable of producing 500 tonnes per year of 70% sorbitol is estimated at Rs 18.67 lakh (Rs 12.00 lakh on plant, equipment and building, and Rs 6.67 lakh as working capital). The cost of production of 70% sorbitol according to NCL process comes to about Rs 3.60 per kg.

A high-pressure hydrogenation process has also been worked out successfully, effecting reduction in the time-cycle and in the catalyst consumption.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Benzoic Acid

Benzoic acid is used as a preservative of foods, pharmaceutical preparations and cosmetics. It is also used, in relatively small quantities, in paints, varnishes, lacquers and enamels. Benzoic acid is an imported item and the imports in 1970-71 amounted to about 174 tonnes valued at Rs 7.06 lakh. Recently, a firm in Bombay has set up a plant with a licensed capacity of 900 kg per day.

The Regional Research Laboratory (RRL), Hyderabad, has developed a process for the manufacture of benzoic acid, starting from toluene. The process consists in passing toluene containing soluble catalyst and air co-currently through a jacketed tubular reactor where the reaction temperature and pressure are maintained between specific ranges. The exit gas containing entrained toluene is passed through an entrainment chamber, condenser and scrubber for toluene recovery. The toluene recovered is recycled to the reactor.

The reaction product stream containing 30-40% benzoic acid and a small amount of benzaldehyde, benzyl benzoate and tarry product, etc. is steam-distilled to recover, toluene and benzoic acid is finally obtained by steam

distillation using super-heated steam. The catalyst is recovered from the residue.

The process developed at RRL, Hyderabad is a single-step continuous process using lesser quantity of raw materials. Moreover, it involves only mild steel and stainless steel as materials of construction, and gives purer product with better yields. The cost of production by this process is estimated at Rs 2.80 per kg, while the European market price of the pharmaceutical grade material is about Rs 5.80 per kg. Thus, the product appears to have export potential.

After completing the laboratory studies, scale-up work has been carried out for 40 kg per day capacity unit.

Toluene and catalyst (besides air) are the raw materials needed in the process, and are available indigenously.

The various items of plant and machinery required are: storage tank, reactor, condenser, separator, scrubber, regenerator, distillation column, storage vessel, drier, incinerator, compressor and boiler.

The suggested minimum economic unit for the production of benzoic acid by this process is 900 tonnes per annum. The total capital investment for a plant of 3 tonnes per day capacity is estimated at Rs 35.45 lakh (Rs 1.86 lakh on land and building, Rs 26.00 lakh on plant and machinery, and Rs 7.56 lakh as working capital).

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Phenoxyacetic Acid

Phenoxyacetic (PAA) is used in the manufacture of penicillin V. At present a firm in Ahmedabad is manufacturing this compound but its production being insufficient, the bulk of the requirements is met through imports. The demand for PAA, based on the requirements of penicillin V, is estimated at 20 tonnes per annum.

A process for the manufacture of phenoxyacetic acid has been developed

by the National Chemical Laboratory (NCL), Poona. The process consists in reacting phenol and monochloroacetic acid with sodium hydroxide when respective sodium salts are obtained; interaction of the sodium salts and acidification of the mixture yields phenoxyacetic acid. The investigations at NCL have been carried out on a pilot plant of 50 kg per batch scale. The laboratory product has been found to be satisfactory for the manufacture of penicillin V.

Phenol, monochloroacetic acid, sulphuric acid, and caustic soda are the main raw materials required for the manufacture of phenoxyacetic acid. All the raw materials are available indigenously.

Glass-lined reaction vessel (jacketed), stainless steel (SS) storage vessel, SS crystallization/washing vessels (jacketed), centrifuge, tray drier, and acid pump are the major items of plant and equipment. All these are either indigenously available or can be fabricated in the country.

The optimum economic capacity as assumed by the laboratory is 20 tonnes per annum. The capital outlay for a plant of this size is estimated at Rs 2.39 lakh (Rs 1.50 lakh on land, building, plant and equipment, and Rs 0.89 lakh as working capital). The cost of production of phenoxyacetic acid by this process comes to Rs 15 per kg.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Antifungal Paper

A serious limitation which hampers the export of leather goods, amounting annually to about 7 million footwear and 11 million other types of leather articles, is mould growth, which causes considerable damage to the finished leather goods and footwear during transport. To overcome this drawback the Central Leather Research Institute, Madras has developed an antifungal paper.

The salient features of the antifungal paper, which is prepared by spraying or brushing the specially prepared chemical on ordinary paper, are that: (i) the fungicidal effect is long-lasting (up to 12 months); (ii) the paper produces no irritation to human skin; and (iii) it is very cheap and at the same time superior to similar products available in the market.

The annual demand for the fungicidal paper is estimated at 87 million sq ft, valued (excluding the cost of the base paper) at about Rs 2.20 lakh. Large quantities of the sample paper produced in a pilot plant scale have been well received by the trade.

As the process is very simple, requiring only a few brushes or a spraying machine and a few indigenously available chemicals, the paper can be prepared without difficulty by cottage industries or those engaged in making leather goods auxiliaries.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

PATENTS ACCEPTED

Indian Pat. 128684

Process for manufacture of building bodies such as bricks, building blocks, roofing tiles and the like, utilizing fly ash, bottom ash of pulverized coal-fired thermal power stations, ash from shales and washery rejects and/or sinks

S. K. Majumder, S. N. Mukherjee, A. K. Moitra, S. K. Dasgupta & A. Lahiri
CFRI, Dhanbad

Building or engineering bricks are generally manufactured from clays by firing. The process under reference relates to the manufacture of building bodies such as bricks, building blocks and roofing tiles by judicious mixing of a variety of raw materials like fly ash and bottom ash from pulverized coal-fired thermal power stations, ash from shales (byproducts of coal mining), ashes from rejects and/or sinks (higher gravity fractions of coaly material obtained during washing of coal) and other ingredients like sand, lime, cement, and gypsum and accelerating

agents. The process utilizes the basic pozzolanic property of fly ash-bottom ash system.

About 4 million tonnes of fly ash and 1 million tonnes of bottom ash are produced annually in the power stations in the country. The production will exceed 10 million tonnes per annum by 1980 with the expansion of the existing plants and installation of new plants. Fly ash is a waste material and practically finds very little use in India. Besides, the disposal of fly ash is a problem and involves considerable expenditure.

The process consists of mixing requisite amount of the raw materials with water in a pan mixer. The mix is pressed in brick moulds. The moulded building units are dried under natural drying and cured. Curing can be done in steam. The bricks (or building units) develop strength during the curing operation.

The characteristics of the bricks, which resemble cement in colour, are: weight of unit volume, 100 lb/ft³; crushing strength, 1000-3000 lb/in²; and water holding capacity, 16-18%. The bricks do not show any adverse reaction with sodium chloride solution.

A tentative estimate of cost per 1000 bricks comes to Rs 125 on the basis of a production of 7.2 million bricks per annum. A capital investment of Rs 1.8-1.9 million is required, and the equipments, chemicals, etc. are available indigenously.

Indian Pat. 129038

Improvements in or relating to development of anodes based on aluminium and its alloys for cathodic protection

V. Balasubramanian, P. L. Joseph, B. A. Shenoi, N. Subramanian & V. Kapali
CECRI, Karaikudi

The process under patent relates to a method for casting an alloy of aluminium, zinc and mercury. The ternary alloy pieces thus cast can protect costly metallic structures from corrosion, especially in sea-water, when these pieces are effectively in 'galvanic contact' with the structures. These pieces are preferentially corroded under these

circumstances and the structures to be protected are maintained intact. Such pieces are therefore called sacrificial anodes and this type of protection is known as cathodic protection.

Aluminium is the major constituent of this ternary alloy. Both aluminium and zinc are available indigenously, and mercury is required only in small quantities.

The anode thus made has all the desirable performance characteristics expected of an efficient sacrificial anode. Its performance compares favourably with that of presently available commercial type anodes, cast usually from metals like magnesium, aluminium and zinc, or their alloys.

The anode has ease of dissolution without passivation, dissolving only to the extent required for the purpose, and generates sufficient electromotive force to offer cathodic protection to the structures.

The alloy is prepared by a special technique in which mercury is added to the aluminium-zinc alloy without loss of mercury.

The performance characteristics of the alloy are as follows: anode efficiency, 85%; anode potential, -1.01-1.03 V (w.r.t. SCE) in 3% NaCl solution or sea-water even at a low current density of 3 mA/cm²; and driving voltage, 260 mV.

Indian Pat. 130124

Process for preparation of low bulk density aluminium silicate for use as insecticide and as carrier for pesticides

H. M. Bhavnagary & S. K. Majumder
CFTRI, Mysore

The conventional method of preparing aluminium silicate is by treating aluminium chloride solution with aqueous sodium silicate which yields a gelatinous precipitate. It is difficult to filter the precipitate free from other salts. On drying, the precipitate has low surface value and high bulk density. The hitherto known process of preparing non-gelatinous precipitate of aluminium silicate is based on (i) precipitation of calcium silicate by treating sodium silicate solution with aqueous calcium chloride, and (ii) precipita-

tion of aluminium silicate by the action of aluminium chloride on the suspension of calcium silicate precipitate in water.

The process covered by the patent under reference consists of (i) treating the aluminium chloride solution having optimum concentration and pH value with sodium silicate solution at elevated temperature to precipitate non-gelatinous and easily filtrable aluminium silicate, (ii) filtering the precipitate on a vacuum filter and washing free of chloride or sulphate ions with de-ionized water, and (iii) drying the precipitate at 200°C. It has a high surface value, low bulk density and high water and oil absorption which are pre-requisites for insecticidal action and as carrier for pesticides.

PATENTS FILED

2049/72: Titanium substrate insoluble anode assembly for diaphragm type chlor-alkali cells, R. T. Nadar, H. V. K. Udupa, B. R. Yadav & P. Subbiah—CECRI, Karaikudi.

2089/72: Titanium substrate insoluble anode assembly for mercury type chlor-alkali cells, R. T. Nadar, H. V. K. Udupa, B. R. Yadav & P. Subbiah—CECRI, Karaikudi.

2107/72: Improvements in or relating to drive arrangements for foil materials through continuous processing equipment with special reference to the maintenance of constant linear speed, B. A. Shenoi, R. Radhakrishnan, V. Lakshminarasimhan & K. R. Narasimhan—CECRI, Karaikudi.

2108/72: A process relating to the production of stable fungal amyloglucosidase concentrate and its application in starch processing, K. R. Sreekantiah, S. A. Jaleel & T. N. Ramachandra Rao—CFTRI, Mysore.

2149/72: Motor-operated jack, S. S. Jain—SERC, Roorkee.

2168/72: A process to coat steel surfaces with vinyl compositions and the products thus coated, P. Peri, S. R. Addanki, A. N. Mukherji & V. A. Altekar—NML, Jamshedpur.



MYSCHEENNA
6 JUL 1973

Geodynamics of Himalaya and South East Asia Seminar at NGRI

An international seminar on Geodynamics of Himalaya and South East Asia was held at the National Geophysical Research Institute (NGRI), Hyderabad, from 5 to 8 March 1973 under the auspices of the Inter-Union Commission for Geodynamics (ICG), Paris. The institute was one of the sponsors of the seminar. The Geodynamics Project is an interdisciplinary, international programme of research on the dynamics and dynamic history of the earth with emphasis on deep-seated foundations of geological phenomena. The project includes investigations related to past and present movements and deformations of the lithosphere, all relevant properties of the earth's interior and specially any evidence of motions at depth and their causes.

More than 40 papers were presented and discussed at the seminar which was attended by earth scientists from India, Japan, Australia, USSR, France, Iran, Switzerland and the Federal Republic of Germany.

Inaugurating the seminar, Shri C. Subramaniam, Union Minister of Industrial Development, and Science and Technology, observed that a systematic study of geodynamics could enable not only the development of improved means of deducing the occurrence of economic minerals but would lead to the protection of world population against natural disasters such as earthquakes. He stressed the need for locating new reserves of uranium within the next decade or so for atomic power generation to avert the impend-

ing world energy crisis. He assured all governmental support to such international endeavours for peaceful utilization of the earth's resources.

Miss F. Delany, Acting Secretary of ICG, speaking on the occasion, attributed the recent revolution in earth sciences to the availability of more sophisticated instruments and improved methods of interpretation. She pointed out that 46 national committees have been formed in different countries which will evolve and execute national programmes under the Geodynamics Project. The present seminar and the meeting of ICG Working Group 3(b) was aimed principally at clarifying the state of art and evolving programmes of interdisciplinary research.

In his welcome address, Dr Hari Narain, chairman of the ICG Working Group 3(b) and Director, NGRI, pointed out that the Upper Mantle Project led to new concepts such as sea-floor spreading and plate tectonics which have created a revolution in earth sciences. Many theories and hypotheses have been modified or altered, thus laying foundations for further studies on the dynamics of the earth's interior which may be responsible for such surface features as mountains, valleys and mineral emplacement in the upper layers of the crust.

Brief accounts of the papers presented at the seminar follow :

Attributing the evolution of Himalaya to the rapid movement of the Indian Plate, A. Gansser (Switzerland) indicated formations of Himalaya to

be collision type of mountain building in contrast to the cordilleran type, possibly responsible for the Andese of South America.

K. L. Khosla (Survey of India) proposed periodical measurement of the heights of Mt Everest and other Himalayan peaks with a view to detecting their possible uplift.

Describing the geological structure of the Alpine-Mediterranean region in the light of plate tectonics, Hans Berckhemer (Federal Republic of Germany) attributed the uplift to the melting and expansion of low-velocity zone below the Alpine region as revealed by multi-disciplinary geophysical profiles run across the Alps.

Investigations undertaken by NGRI in the Himalayan region were reviewed by Harsh K. Gupta of NGRI. Surface wave dispersion studies have shown extremely low velocities in the crust and upper mantle in the Himalayan region. Body waves have also been interpreted in Hindukush and other key regions of Alpine orogeny. B. K. Rastogi (NGRI) described the earthquake focal mechanism studies in Himalaya-Burma region. The findings are consistent with the hypothesis that the Himalayan mountain chain was formed due to the collision of two continental blocks.

S. Uyeda (Japan) attributed the evolution of Japanese Islands to the movement of Pacific plate. He explained the tectonic structure, volcanism and frequent occurrence of earthquakes in Japan and other geophysical phenomena as due to the consumption of Pacific plate under Japan.

H. M. Chowdhury (India Meteorological Department) emphasized the need for increasing the number of

observatories in the Himalayan region for conducting a detailed study.

The drift theory and the drift of Indian sub-continent in particular were subjects of detailed discussions.

Working Group on Himalayas

The ICG Working Group 3(b) met under the chairmanship of Dr Hari Narain to evolve specific programmes. The group was divided into (i) working group 3(a): Geodynamics of Alpine-Mediterranean region; and (ii) working group 3(b): Geodynamics of Himalayan region. Iran is considered as the zone of overlap.

A number of geotraverses have been proposed for obtaining detailed information in key sectors of Himalaya. In order to have a complete understanding of the geodynamics of Himalaya, a number of geophysical investigations are recommended. These include: (i) establishment of well distributed permanent seismological

stations to increase detectability of earthquakes and operation of mobile seismic stations to collect data on microearthquakes; (ii) investigation of physical properties of deep-crust and upper mantle by surface wave dispersion and deep seismic sounding studies; and (iii) gravity magnetic surveys of sufficient width along recommended geotraverses and study of contemporary crustal movements and stresses along active fault zones.

Some of the general recommendations of the group relate to: (i) early publication of maps and documents (both national and international); (ii) procurement of aerial photographs taken under ERTS (Earth Resources Technological Satellite) programme for interpreting geological features covering the entire Alpine-Himalayan region; and (iii) field colloquia to study and compare the critical areas and stimulate exchange of information on an international basis.

Get-together of Salt and Marine Chemicals Industry and Scientists : CSMCRI

The second get-together between salt and marine chemicals industry and scientists was held on 23 March 1973 at the Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, and was attended by 50 delegates from all over the country.

While welcoming, Dr D. J. Mehta, Scientist-in-charge, CSMCRI, called upon the participants to exploit the technical know-how developed by the institute. Emphasizing the need for potash fertilizers in the country, Dr Mehta informed the gathering that the Government of India has decided to include potassium schoenite, for which the know-how has been developed by CSMCRI, in the Fertilizer Control Order.

In his inaugural address, Shri C. L. Malhotra, Salt Commissioner, dealt with the present status and future prospects of the salt industry and the problems faced by the industry. Laying emphasis on the improvement of the

quality of salt, he called for the mechanization of various operations in salt manufacture, particularly the future salt works, and for the setting up of export-oriented salt works.

The problems faced by the industries were with respect to layout of solar and inland salt works, improvement in the quality of salt to conform to industrial grade, and increasing the yield. Covering of heaped salt to protect it from monsoon in regions of excessive rainfall, measures to resist percolation, and washing of salt were the general problems posed by the industry. The scientists suggested remedial measures to be adopted for each problem.

With regard to the recovery of by-products, emphasis was laid on the recovery of (i) schoenite for which a plant is operating at Tuticorin; (ii) bromine for which a plant is operating at Navlakhi; and (iii) magnesium compounds based on the know-how developed by CSMCRI.

The setting up of a consultative committee for salt and marine chemicals under the chairmanship of the Scientist-in-charge of the institute and with representatives from the industry was suggested.

BITM's Fourteenth Anniversary Celebrations

The Birla Industrial and Technological Museum (BITM), Calcutta, celebrated from 2 to 8 May 1973 the fourteenth anniversary of its founding. The celebrations included the following programmes: photographic exhibition on the growth of the museum; demonstration of 'robot' and 'remote control boat'; science quiz contest and debate for school students; popular lectures on science topics; sky observation through astronomical telescope; technical film shows; and demonstration of model aircraft flying (in collaboration with the All India Aeromodellers Association).

Dr N. R. Kar, Director of Public Instruction, Government of West Bengal, who inaugurated the programmes on 2 May, said that the museum was doing a great service in popularizing science. Dr D. Basu, Director, Indian Association for the Cultivation of Science, Calcutta, presided over the function. In his welcome address, Shri A. Bose, Director of Museums, CSIR, traced the history of BITM, the first science museum in India, and also explained its educational activities, including the mobile science exhibitions and regional science centres in the districts.

Bangladesh Technical Team Visits CFRI

A technical delegation led by Dr F. H. Khan, Chairman, Bangladesh Mineral Exploration and Development Corporation, and Shri M. Ahmed, Deputy Director General of the Geological Survey of Bangladesh, visited the Central Fuel Research Institute (CFRI), Dhanbad on 12 May 1973 to acquaint themselves of the researches on coal utilization in India and to explore the possibility of collaboration with India.

Dr A. Lahiri, Director, CFRI, discussed with the delegates the areas of interest, especially briquetting, coal washing, formed coke, gasification, integrated development of coal and limestone deposits for cement manufacture, and gave them an idea of the development in India and the availability of project engineering expertise at government level.

In this connection, the Director also offered the services of CFRI for developing schemes of integrated coal utilization through the collaboration of design engineering organizations, such as the Engineering Projects (India) Ltd. The institute also offered to undertake high-pressure briquetting and drying tests on Sunderbans peat. The scheme on the utilization of Bogra coal, a project in which a German firm is to collaborate with the Bangladesh Government, is of particular interest to CFRI.

CMRS Helps in Reducing Mine Blasting Cost

The blasting research unit, a newly set up unit of the Central Mining Research Station (CMRS), Dhanbad, is assisting mine managements to improve the techniques of blasting with a view to producing better products at reduced cost and with greater safety. Investigations on four projects have been completed and work on two projects is in hand.

In a large iron ore mine producing nearly 1.8 million tonnes of ore annually, CMRS' investigations have helped increase productivity from 9.42 to 21.7 m³ of ore per meter of drilling. The charge factor (kilogram of explosives per cubic metre of solid ore) could be reduced from 0.82 to 0.72.

In another opencast metal mine, the CMRS team developed a suitable boosting system and an optimum blasting pattern. This resulted in increasing the loading density of the explosive from 1.9 to 2.37 kg/ft and in decreasing the cost of explosive to an all-time lowest figure of Rs 4.40 per 100 ft³. The production per kilogram of explosive was 5.40 tonnes, which was the highest

figure for that mine.

In another project in an experimental tunnel, the team developed a blasting pattern which would be most suitable for the type of rock available there. The data obtained in the course of the investigation would enable the sponsor to obtain a realistic cost structure of the proposed irrigation tunnel.

The research team also evolved a relationship between the strength of rock, work output of the machine and penetration rate in another iron ore mine where difficulties in drilling hematite led to poor productivity. As a result, optimum penetration performance could be predicted under various conditions as obtainable in the mine and the causes of unsatisfactory penetration rate could also be predicted. The team also worked out ways to improve drilling efficiency.

The team is currently engaged in an investigation to suggest a suitable type of drilling machinery and blasting system for a proposed mine. It is also investigating into the safety in blasting operation where premature detonation may occur due to the generation of

electrostatic charges during pneumatic conveyance of ANFO mix powder.

CEERI Develops Electret Condenser Microphone

Electret condenser microphones have an advantage over conventional condenser microphones in that the requirements of dc polarizing voltage is not essential. This is achieved by the use of prepolarized electrets as diaphragm. The electret used is a thin polyester film one side of which is metallized. These diaphragms are polarized at elevated temperatures in the presence of a strong electric field. The diaphragms lose a fraction of their surface charge soon after the polarization process but retain most of it. This manifests itself in the sensitivity of the microphone decreasing by 2 or 3 db within a few days after assembly. The electret condenser microphone developed by the Central Electronics Engineering Research Institute (CEERI), Pilani, has a sensitivity of -63db. Its frequency response is uniform (within ± 2 db) from 40 Hz to 18 kHz.

Electret condenser microphones can



Electret condenser microphones developed by CEERI, Pilani

be used as general purpose microphones in studios and auditoria, and with tape recorders. They can be made in different sizes and shapes.

CMDA to Utilize CFRI Process on Building Bricks from Fly Ash

The process for the manufacture of building bricks from fly ash — a waste product of pulverized coal-fired power stations—developed earlier by the Central Fuel Research Institute (CFRI), Dhanbad, has been accepted by the Calcutta Metropolitan Development Authority (CMDA) for establishing a pilot plant for the production of fly ash based bricks (6000/hr) at Bandel in West Bengal. The National Research Development Corporation of India, through whom the process is being released, is expected to offer financial assistance to the extent of Rs one

million towards the project. The plant is expected to cost about Rs 6.70 million.

The process (Indian Pat. 128684) consists in mixing a judicious proportion of fly ash, sized bottom ash, shale ash, etc. with lime, sand and cement, where necessary, along with certain accelerating agents (chlorides). Requisite quantity of water is added and the mix is pressed. The moulded product is dried and steam-cured. The cured products have a porosity of less than 20% and a crushing strength of 1000–3000 psi. The estimated cost of making 1000 bricks based on the CFRI process is Rs 125, which compares favourably with the price of commercial, fired bricks of comparable quality.

Adequate numbers of fly ash sample bricks were made with the help of a local refractory works, and were sent for inspection by CMDA.

report on the effectiveness of the composition is encouraging. The composition is likely to be used as a substitute for an imported product.

Investigations on the use of dolomitic limes in making lime-burnt clay puzzolana mixture were continued. Some of the aspects studied on lime-burnt clay puzzolana were: drying shrinkage characteristics, durability against alternate freezing and thawing, and resistance to sulphate attack of mortars made with such mixtures.

A procedure has been evolved for the design of cement concrete mixes on the basis of the relationship between flexural strength and compressive strength. A design chart for determining the required water : cement ratio from the design flexural strength has also been prepared.

Field work on an Indian Roads Congress Road Tests Project, viz. development of appropriate serviceability rating indices for rigid and flexible pavement, was completed in all the four zones in the country. The data are being analyzed in order to develop correlations between the subjective rating of serviceability by the road users and the objective ground measurement of various parameters which affect its serviceability.

The existing road patterns in industrial townships in India are being studied in order to work out suitable standards for road network for such townships. Data were collected in respect of four industrial township, viz. Bhilai Steel Plant at Bhilai, Heavy Engineering Corporation at Ranchi, Heavy Electricals India Ltd at Bhopal, and Fertilizer Corporation of India at Nangal. On the basis of the analysis, road widths for different categories of roads, namely residential streets, collector streets, arterial roads outside the townships and those carrying intra- and inter-city traffic, were suggested.

An important project concerned with bridges relates to the strengthening of bridges by post-tensioning. Earlier studies were aimed at strengthening single-span simply supported bridge

PROGRESS REPORTS

CRRI Annual Report : 1971-72

The annual report of the Central Road Research Institute (CRRI), New Delhi, for 1971-72 records the progress of R & D work under the following sub-disciplines: Soils; Flexible pavements; Rigid pavements; Roads; Traffic engineering, economics and statistics; Extension; and Bridges. Eighty-three projects in all were investigated during the year.

Continuing its role as consultant to various highway engineering organizations in general and the Border Roads Organization in particular the institute undertook 24 landslide projects during the period and formulated corrective measures. Some of the important roads on which landslide problems were tackled are: (i) National Highway, NH-31-A; (ii) North Sikkim Highway; (iii) Gangtok-Nathula Road; (iv) Keukhola-Lungthu Road; (v) Rishi-Rangli Road; and (vi) Rishi-Algarah-Dum Dim Road. In addition, corrective measures were recommended for the subsidence of the Lakkar Bazar Road and Debris Slide at Snowdon, Simla,

referred to by the Simla Municipal Corporation and the Government of Himachal Pradesh respectively.

The effect of mixing and compacting viscosities on the properties of bituminous mixtures and their influence on the performance of bituminous pavements was investigated.

The advantages of using tar-bitumen mixes in preference to conventional binders is being investigated. The miscibility of tar-bitumen was studied and the following conclusions were arrived at: (i) Flocculation occurs in tar-bitumen mixtures as the quantity of bitumen oil (maltenes) increases in the bitumen; (ii) the presence of wax in the bitumen hinders the miscibility considerably; and (iii) to overcome flocculation due to higher quantities of maltenes and wax in the bitumen, the pitch/anthracene oil ratio of the tar should be reduced.

A special type of mastic has been formulated for a chemical works for protecting the lead underneath the electrolytic diaphragm cell producing caustic soda and chlorine. Initial

spans by post-tensioning externally. In the present studies, the method of converting simply supported spans to continuous spans with external prestressing cables, thereby strengthening the spans, is being investigated.

Various aspects of economy in the design of retaining walls with relief shelves were studied. It was observed that in the case of a retaining wall with a single shelf, a relief shelf of width $0.4 D$ located at $0.55 D$ from the top (where D is the total depth of wall) gave maximum economy. The saving in steel was about 20%, in earth work of about 25%, and the saving in concrete was counterbalanced by the additional concrete in shelf and

for form work. Provision of more than one shelf was also found economical but the rate of saving was reduced with the increase in the number of shelves.

Some of the important projects of consultancy work, besides landslide analysis, undertaken by CRRRI relate to: embankments on refuse dumps; foundation problems in various harbour projects; investigations for strengthening of road and runway pavements; designing of road pavements; improvement in the geometrics of road intersections for free flow of traffic; and comprehensive traffic and transportation studies in Greater Delhi.

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

Interpolymer Type Cation and Anion Exchange Membranes

Ion-exchange membranes possess permselective properties: an anion-exchange membrane is permeable exclusively to anions while a cation-exchange membrane is permeable exclusively to cations. They are extensively used in electrodialysis applications and in general in processes involving separation of ions by the passage of an electric current through a series of chambers separated by them. Such processes include the removal of ionic constituents from an aqueous solution such as brackish water or sea-water, purification of industrial liquids such as sugar syrup or glycerine, removal of salt constituents from milk and whey, hydrolyzing salts of weak acids and weak bases, double decomposition of salts, etc. These membranes can also be used as electrodes with instruments like potentiometer.

Ion-exchange membranes are not known to be produced in India so far. Also, they have to be introduced in the various commercial fields listed above and therefore great potentiality exists for their exploitation. Preparation of ion-exchange membranes

involves the formation of an intermediate interpolymer.

Interpolymers are made in a variety of ways. One way is to dissolve the respective polymers in suitable solvents and homogenize them and later remove the solvents. Another method consists in melting the two polymers and homogenizing them. This necessitates high temperatures and the resultant products can decompose and/or deteriorate. Moreover, these two processes are suitable only for linear polymers.

The process developed by the Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, involves the dispersion of a hydrophobic polymer in a suitable solvent at moderate temperatures. A suitable monomer is then added to the dispersed polymer and polymerized with a suitable catalyst.

After the polymerization is completed under suitable thermal conditions, the solvent is removed by heating the product under vacuum and the interpolymer composition is cured at a moderate temperature. The loading of the hydrophobic polymer with the monomer(s) is such that the sheeting of the interpolymer into films

is possible by means of rolling on hot rollers, hot calendering or extrusion. Subsequent chemical processing is carried out to obtain cation and anion-exchange membranes.

The main advantage of the process is that it offers a wide range of compositions for the preparation of tailor-made cation and anion-exchange membranes to suit the individual needs in process applications where ion-exchange membranes are used.

Polyethylene, styrene, divinylbenzene, toluene, benzoyl peroxide, sulphuric acid, nitrobenzene, chlorodimethyl ether, anhydrous aluminium chloride, and trimethylamine are the raw materials required in the process.

The main items of equipment include: polymerization kettle, drying oven, chopper, extruder, pelletizer and film winder, sulphonation plant of continuous type (glass-lined), and chloromethylation and amination plant (glass-lined). All the equipment are available in the country.

The suggested capacity for an economic unit is 100 m^2 each of cation and anion-exchange type. The cost of production worked out is Rs 32.60 per metre of membrane pair.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Continuous Countercurrent Ion-Exchange Softening Unit

A continuous countercurrent ion-exchange unit for softening water has been designed and developed by the Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar. The unit consists of three columns, one each for (i) exhaustion, (ii) regeneration, and (iii) rinsing operations. The raw water to be treated enters the exhaustion column through a non-return valve fixed on the wall of the column near the bottom and comes through the outlet

near the top of the column. The rinsed resin enters the column from the top after being dewatered. Because of higher density the resin settles at the bottom and is continuously transferred to the top of the regenerating column through the tube, with the help of compressed air. Regenerating solutions are continuously fed at a predetermined flow rate through a non-return valve fixed on the wall of the column near the bottom. The regenerated resin, which settles at the bottom, is similarly transferred to complete the continuous cycle. The dewatering device designed and fabricated at CSMCRI helps in removing the water which is carried over along with the transferred resin.

To prevent air from entering the column, small jackets with air vents are provided between the dewatering device and the column.

For treating a known volume of water of definite composition this unit has the following advantages over the conventional fixed-bed system : (1) The quantity of the resin required is reduced to a third. (2) The quantity of the regenerant required is also reduced. (3) The idle period for regeneration and rinsing, etc. is completely eliminated as the three steps, viz. exhaustion, regeneration and rinsing, are carried out simultaneously in three different columns continuously. (4) The cost on equipment is cut down as the size of the column is reduced because of lower resin requirement.

The possibility of resin carryover along with the treated water is eliminated in the design by the provision of a false partition of a 60-mesh stainless steel sieve at the top of the exhaustion column below the outlet connection and the rate of flow of the treated water is adjusted in such a way that the resin falling from the top is not prevented from settling by the upward thrust of the water flow.

The plant was operated at the flow rate of 2500 litres/hr with initial hardness of water in the range of 300 ppm as CaCO_3 . A product water of commercial zero hardness was obtained.

Exhaustive data have been collected by operating the plant. Continuous running of the plant for 50 hr was also taken up to investigate the difficulties, if any, in the operation of the plant. No change in the particle size of the resin was observed after 174 hr of continuous use.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Scopolamine Hydrobromide from *Datura innoxia* and *Datura metel* Seeds

Scopolamine is used as a preanaesthetic in surgery and child birth, in ophthalmology, and in the prevention of motion sickness. It is a syrupy liquid soluble in organic solvents. The hydrobromide is soluble in water and is used as a sedative. A cerebral depressant useful in agitated or maniacal conditions, the drug is also used for producing amnesia and partial analgesia in labour. At present there is no indigenous production of the material and the entire requirements are met through imports. *Datura innoxia* and *Datura metel* seeds contain scopolamine and a fixed oil. The latter is used for soap-making and for other non-edible purposes. The demand for scopolamine is bound to increase once it is available in considerable quantities.

The Regional Research Laboratory (RRL), Jammu, has successfully developed a process for the preparation of scopolamine hydrobromide from the seeds of *D. innoxia* and *D. metel*. The process consists essentially of defatting the seeds which are extracted with benzene. The bases are separated as sulphates, from which scopolamine is obtained as hydrobromide. The work has been conducted on a scale of 500 kg seed per batch. The yield of scopolamine hydrobromide is 0.1% (w/w), while 15-20% of fixed oil is obtained as a byproduct. The product conforms to I.P. standards. The laboratory has sold about 400g of

scopolamine hydrobromide.

D. innoxia and *D. metel* seeds are the major raw materials. *D. innoxia* is found grown in western Himalayas, the hilly regions of the western parts of Deccan peninsula and a few other places in India. *D. metel*, on the other hand, is a subglabrous spreading herb, sometimes becoming shrubby. It occurs throughout India and is occasionally grown in gardens. The dried leaves and flowering tops of *D. metel* and those of *D. innoxia* have been known for their narcotic and antispasmodic properties. The drug used in commerce is collected mostly from wild plants. Other raw materials like solvents, sulphuric acid, and liquor ammonia are all available indigenously.

Mild steel extractor, grinding machines, boiler, distillation unit and deep freeze are the major items of plant and equipment. All these can be fabricated in the country. Since the process involves the use of solvents, safety measures will have to be taken.

The total capital outlay for a plant capable of producing 100 kg of scopolamine hydrobromide is estimated at Rs 5.40 lakh (Rs 2.90 lakh as fixed capital and Rs 2.50 lakh as working capital). The cost of production of scopolamine hydrobromide comes to Rs 8000 per kg. A unit already engaged in the production of alkaloids could take up the manufacture of scopolamine hydrobromide with advantage.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

N, N-Dimethylbiguanide Hydrochloride & Phenethylbiguanide Hydrochloride

N, N-Dimethylbiguanide hydrochloride (DMBG-HCl) and phenethylbiguanide hydrochloride (PEBG-HCl) are valuable antidiabetic drugs. These drugs are presently imported under the trade names Metformin (DMBG-HCl) and Phenformin (PEBG-HCl).

In 1969-70 the imports of DMBG-HCl amounted to about 670 kg, valued at Rs 90 000 and of PEBG-HCl amounted to 907 kg, valued at about Rs 1.23 lakh.

No precise estimate of the demand for these drugs can be made. Bengal Immunity Co. Ltd, Calcutta, are reported to be manufacturing Phenformin.

The National Chemical Laboratory (NCL), Poona, has developed processes for the preparation of these compounds.

DMBG-HCl: Dimethylamine hydrochloride is prepared from the amine solution and reacted with dicyandiamide in the presence of a suitable solvent. The product is isolated and purified.

PEBG-HCl: β -Phenylethylamine hydrochloride is prepared from the amine and reacted with dicyandiamide in the presence of a suitable solvent. The product is isolated and purified.

The preparation of DMBG-HCl has been carried out on 500 g per batch scale and that of PEBG-HCl on 100 g per batch scale. The products have been found to conform to the required standards.

Dimethylamine, β -phenylethylamine, dicyandiamide, hydrochloric acid, and solvents are the main raw materials required for the production of these drugs. Of these, dimethylamine, β -phenylethylamine and dicyandiamide will have to be imported for the time being. Dimethylamine is likely to be produced in the near future by the Fertilizer Corporation of India, Trombay. The other two raw materials will have to be imported.

Glass-lined reactor or all-glass flasks, centrifuge, solvent recovery unit, boiler, storage vessels, and driers are the important items of plant and equipment. All these are either indigenously available or can be fabricated in the country.

The optimum capacity has been assumed as one tonne per annum for each of the products. The fixed capital on plant and building for both the products has been estimated at

Rs 1.90 lakh, while working capital has been estimated at Rs 85 000 for DMBG-HCl and Rs 2.95 lakh for PEBG-HCl. It has been further assumed that the plant capacity will be 12 tonnes per annum, which will consist of general equipment and could be utilized for producing these drugs for two months and for the rest of the period, the plant, labour and supervision could be used for making other products. The cost of production of DMBG-HCl comes to Rs 17.44 per kg, while that of PEBG-HCl comes to Rs 55.20 per kg.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

PATENTS ACCEPTED

Indian Pat. 130294

Improvements in or relating to glass-coated glass fibres

J. P. Shaha

CSIO, Chandigarh

In selecting a pair of glasses for glass-coated glass fibres, the physical and chemical compatibility of the core and clad materials is an essential requirement for obtaining better transmission of light. The chemical compatibility is observed to play a more prominent role in the selection of these glasses for fibre. On this criterion, the patent covers the selection of a commercial glass as clad material available in the form of tubings, which proves suitable for optical core glasses. Better transmission is obtained in this case than in the other commercial glasses available in the form of tubings.

Indian Pat. 129108

Improvements in or relating to a process for manufacture of weather-resistant, smokeless, hard and moulded fuels from coke breeze for domestic and/or industrial purposes

A. K. Chakravarty, P. K. Das, S. Gupta, P. Sen Gupta, A. K. Sen Gupta, N. N. Chatterjee & A. Lahiri

CFRI, Dhanbad

Undersized coke (13 mm-0) is produced to a large extent in the process of metallurgical coke production. This coke (coke breeze), which constitutes

about 7% of the total coke, has limited use owing to its small size and very low ignitability.

The process covered by the patent enables the utilization of the coke breeze for producing excellent shaped fuel for domestic and/or industrial uses. The fuel produced is smokeless, hard, weather- and water-resistant. It possesses satisfactory combustion characteristics in conventional domestic *chulas* (coke stoves), which is comparable to that of smokeless solid fuel available in the market.

The process consists in crushing the coke breeze, mixing with tar/asphalt binder, briquetting at low pressure to ovoid or suitable shape and thermally treating the briquettes in an oxidizing atmosphere for necessary hardening and desmoking.

The process is cheap and can be applied to high or low temperature coke fines and similar materials.

Indian Pat. 129510

Preparation of electro-deposits on mild steel from aqueous resin system of linseed oil-maleic acid/anhydride

S. Guruswamy & S. Krishnamoorthy

CECRI, Karaikudi

Organic film formers are used to provide coatings over metals for conferring upon them protection against corrosion. Organic coating are also used to provide electrical insulation to metals and also for creating decorative finishes over metal articles. A film-forming organic polymer is dissolved in a suitable organic solvent and the solution applied over the metal surface. The solvent is allowed to evaporate and the resultant coated metal is heat-treated to form a polymerized organic coating. Pigments and corrosion-resistant materials are added to the resin to impart decorative effects and to improve the corrosion resistance of the organic coatings. Generally, the organic solvent used in the above process does not have any useful function other than that of facilitating the formation of a film over the metal surface. The organic solvent has, on the other hand, toxic effects and there is also the risk of fire. Hence the application of

resin from water systems is definitely advantageous. Since water has a high latent heat of vaporization, the drying of an aqueous resin system poses difficulties. The preparation of organic coatings by electrophoretic deposition of resins and pigments overcomes the above difficulties.

In this process, the organic film-forming resins are synthesized from individual polymer-forming ingredients and allowed to grow to a critical size in the range of colloidal entities of the resins. Electrical charge on the particles is produced by incorporating the requisite number of acid groups with amines to obtain charged resin particles of low molecular weight. These particle entities move and deposit in an orderly manner over metals when an electrical potential is applied between the electrode and the article to be coated. In the preparation of water-soluble resins suitable for electro-deposition, the solubility of the individual resin particle entity is controlled by the incorporation of sufficient OH groups. The presence of OH groups in the particle entity of the depositing resin also controls the acidity or the acid number of the resin particle entities. The electrodeposits have to be baked to polymerize the resin so that they develop colour, toughness, resistance to scratch, etc. — properties which are valuable in industrial organic coatings. The use of electric current to deposit the resins has the following advantages: (i) economic utilization of the resin and pigments, (ii) ability to achieve uniform coatings on metal articles of complicated shapes and sizes as well as on the interior surface of metal articles of widely varying sizes and shapes, (iii) elimination of fire and toxic hazards in the preparation of organic coatings over metals on an industrial scale, and (iv) possibility of integrated use of this process in coating metal articles with organic coatings.

The process covered by the patent consists in the preparation of organic coatings over mild steel. Linseed oil-maleic anhydride resin is solubilized

in water by partial neutralization of the acid groups to yield negatively charged polyelectrolyte of the resin. The resin is deposited on the anode by the passage of direct current through the resin system. The resin is baked in order that it develops colour and adhesion.

Indian Pat. 126677

Improvements in or relating to the electrolytic reduction of nitrobenzene to *p*-aminophenol

H. V. K. Udupa, G. S. Subramanian, K. S. Udupa & T. D. Balakrishnan
CECRI, Karaikudi

Electrolytic reduction of nitrobenzene to *p*-aminophenol was till recently being carried out in a glass or glass-lined or porcelain cell using ceramic porous pots as diaphragm. Materials fabricated out of glass and ceramic are fragile and costly. Ceramic porous pots of required dimensions for large-scale work are not readily available and can be obtained only by special orders and at high costs

These difficulties are obviated in this patented process in which teak wood is used as the material of construction of the cell and blue asbestos cloth as diaphragm material. Thus the fabrication of high amperage cells is simplified as the cell and diaphragm of any desired size and shape can be made easily.

The process consists in reducing a suspension of nitrobenzene in a supporting electrolyte of sulphuric acid using rotating/stationary amalgamated cathode of copper, brass, lead-zinc or monel with blue asbestos cloth as diaphragm supported in a wooden frame or on a suitable anode material, viz. lead or lead alloy, in a wooden cell.

PATENTS FILED

2229/72 : New dyes containing azido groups for cellulosic protein and synthetic fibres, N. R. Ayyangar, N. V. Badami, B. D. Tilak & E. H. Daruwalla—NCL, Poona.

2230/72 : An apparatus for taking three-dimensional panoramic X-ray radiographs with conventional radiographic equipment to be seen without

any viewing aids, K. Chandra & K. D. Kundra—NPL, New Delhi.

2231/72 : Improvements in or relating to the preparation of new reactive dyes, N. R. Ayyangar, N. V. Badami, B. D. Tilak & E. H. Daruwalla—NCL, Poona.

2232/72 : Process for the preparation of D-galactose from cashewnut shells, T. R. Ingle, S. H. Vaidya & M. U. Pai—NCL, Poona.

2233/72 : Improvements in or relating to the production of oil well cement additives, A. K. Chakraborty, S. N. Dutta & M. S. Iyengar—RRL, Jorhat.

2234/72 : A process for making three-dimensional panoramic photographic displays to be seen without any viewing aids, K. Chandra & R. C. Dhawan—NPL, New Delhi.

2235/72 : New dyes containing azido groups for cellulosic protein and synthetic fibres, N. R. Ayyangar, N. V. Badami, B. D. Tilak & E. H. Daruwalla—NCL, Poona.

2252/72 : A temperature controller, S. P. Suri, Madhu Khuller & V. P. Wasan—NPL, New Delhi.

2253/72 : A high pressure cell for the production of hydrostatic pressures of order of 70 000 to 80 000 psi, Y. V. Ramana—NGRI, Hyderabad.

2254/72 : An improvement in or related to photo-chemical etching process on plastics for the manufacture of precision protectors, panels for electrical and electronic instruments and slide rules, O. P. Bhola—NPL, New Delhi.

PATENTS SEALED

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123311 : Improvements in or relating to the fabrication of bipolar monolithic integrated circuits, G. L. Sethi—CEERI, Pilani.

124082 : A new process for the preparation of attars and perfumed oils from flowers, L. B. Singh & M. L. Sharma—NBG, Lucknow.



Defects and Damages in Textiles : ATIRA's Ninth Technological Conference

The theme of the ninth technological conference organized by the Ahmedabad Textile Industry's Research Association (ATIRA), Ahmedabad, on 26-27 March 1973, was defects and damages in textiles. A recent ATIRA survey has shown that losses due to defects and damages in various manufacturing processes in the textile industry vary from 2% to 6% of total sales value, i.e. a loss of about Rs 2 million per year for an average sized textile mill.

Nearly 500 delegates participated in this annual meet at which technologists from industry contributed nearly 50% of the technical papers presented.

Inaugurating the conference, Shri Navnitlal Shodhan, chairman of the Council of Administration of ATIRA, said that the industry should resort to judicious modernization so as to avoid becoming 'sick' in future. Modernization could help reduce defects and damages but it cannot be done speedily owing to restraints on finances and procurement of machinery. The theme of this conference should be of great relevance to the industry because it deals with how to reduce defects and damages with the existing machinery, he said. Shri Shodhan suggested that mills should utilize more extensively the concept of 'machinery audit' introduced by ATIRA.

The conference started on a note emphasizing the role of human factors in reducing defects and damages. The technique of 'zero defects' — elimination of all defects attributable to human factors — has been applied in

the Hissar Textile Mills, a unit of the Delhi Cloth Mills (DCM). A paper by H. C. Jain, of DCM, explained the principle of zero defects and the procedure to be adopted for its application.

Two papers devoted to spinning dealt with the various yarn defects such as crackers, hairiness, and slough-off. Although many of these are well-known defects, their causes and remedial measures are not clearly understood. The authors (T. A. Subramanian and J. M. Grover, ATIRA; A. P. Bhargava, Ambica Mills, Ahmedabad; and M. J. Purandare, Asoka Mills, Ahmedabad) dealt in great detail with these defects and clarified many commonly accepted but vague ideas. They put forward mechanisms for the formation of crackers and of slubs. It was shown that crackers could be artificially created. The problem of slubs often assumes immense proportions, especially in polyester-cotton yarns. It had so far been accepted that the only cause of these defects is bad drafting. The authors showed that the card can also contribute substantially to the formation of slubs.

Defects and damages in grey fabrics were analyzed in depth by ATIRA technologists in the second session. The role played by the reed in causing fabric streakiness was re-emphasized. It was shown conclusively that the chances of sufficient yarns, coarser or finer than the nominal, coming together to cause a streak were negligible. Yarns can cause streakiness in fabric only if there is a mix-up of counts.

The working of the reed evaluator developed by ATIRA was explained. The reed evaluator can be used to compare four full reeds simultaneously. Photographic standards can also be established.

An interesting paper on grey fabric inspection system, using differently coloured cards indicating the severity of the defects, was presented by S. Y. Nanal of the Indian Organic Chemicals Ltd, Madras, and S. Maruthi of Anglo-French Textiles Ltd, Pondicherry. A point-rating system, developed by them for quantification of grey fabric defects, was explained. The system has been working successfully in some of the Mafatlal Group of Mills.

The third session, devoted to defects and damages in dyed and printed fabrics, included two papers presented by ATIRA staff and two others presented by technologists from the industry.

The causes of damages during jigger dyeing, a widely used method of dyeing, were presented by S. V. Gokhale of ATIRA. It was shown that by taking certain precautions during jigger dyeing, damage in the dyed cloth could be reduced significantly.

A. M. Desai, Ajit Mills, Ahmedabad, laid particular emphasis on the preparation of cloth for dyeing: by taking proper precautions during the preparation of cloth for dyeing, the damages in the dyeing of cotton fabrics can be minimized. He explained how different types of damages occur in the cloth dyed with different classes of dyestuffs. Measures to prevent the damages were also suggested.

In the printing process stage the extent of defective packing could be of the order of 25-80%. R. C. Shah of

ATIRA stated in his paper that by taking preventive measures, suggested by him, defective packing could be reduced by about 20-25%.

R. M. Gami, of New Commercial Mills, Ahmedabad, narrated his experiences in the control of damages in various styles of printing with different classes of dyestuffs. He especially stressed on the problems and remedies of the printing of rapidogen dyestuffs, vat dyes, reactive dyes and pigment dyes.

CGCRI Develops Glass-bonded Mica

The know-how for making two types of glass-bonded mica based on lead-bearing and lead-free glass has been developed by the Central Glass & Ceramic Research Institute (CGCRI), Calcutta.

Glass-bonded mica — known under various trade names like Mycalex, Mykroy, Havalex, Thermica and Supramica — having the moldability of plastics, the dimensional stability and thermal expansion of stainless steel and the electrical properties of low-loss organic plastics is a basic inorganic insulating material suitable for wide ranges of ambient operating conditions and electrical stresses. Until recently there was little or no demand for glass-bonded mica products in India, but of late the demand for the product is growing, particularly for magnetic switches, lightning arrestor gap plates, switch-gears, and traction motors. The requirement in regard to glass-bonded mica is being met by imports.

Glass-bonded mica is composed of a low-temperature glass and mica flakes, and is a stone-like material, grey to white in colour, having excellent electrical, mechanical and thermal properties. A versatile material, it makes up for all the lacunae in plastics, ceramics, and glass. Parts moulded or machined out of glass-bonded mica operate satisfactorily up to 750°F (400°C) continuously. They are also arc- and radiation-resistant and have thermal expansion matching that of

stainless steel for hermetic seals, headers and similar products. They also offer zero moisture absorption perfect seals, indefinite shelf-life and the highest electrical breakdown stability.

The material is particularly suitable in applications where the insulating material used should have high dielectric strength and close dimensional strength, should be nonhygroscopic and should be capable of being produced in intricate shapes. Some

of its applications include : bases and sockets for transmitter and receiver tubes, switch-board panels, arc shields in high tension switches, circuit breakers, lightning arrestor gap plates, jigs and fixtures in welding, soldering and induction heating, tube bases, coil forms, etc. for high frequency applications, relay contact supports, and X-ray components. The product developed by CGCRI is comparable to foreign products.

PROGRESS REPORTS

CECRI Annual Report : 1972

The annual report of the Central Electrochemical Research Institute (CECRI), Karaikudi, for 1972, which has been published recently, shows that the laboratory made significant progress in the installation of pilot plants. Improvements in the spray drier unit (capacity, 70 kg/hr) of the magnesium pilot plant were effected by successfully employing a single disc atomizer operating at 10 000 rpm to replace the multi-disc system. This has resulted in the smooth functioning of the unit during continuous duty besides rendering scale-up work more easy. Two 10 000 A electrolytic cells for the production of magnesium metal, designed and fabricated earlier, were operated successfully with a current efficiency of 65%. The purity of metal obtained was about 99.8%. Equipments required for continuous phosphating of wire were designed and fabricated. The trichloroethylene degreasing unit was commissioned. A new technique of phosphating ferrous components worked out by the laboratory employs trisodium phosphate, a cheap raw material, and is carried out at room temperature in a mild steel tank. The process finds applications in the manufacture of finished articles made out of steel sheets. Know-how for etching aluminium and aluminium alloy with pure direct current to obtain the desired etch ratio (>40) at 30 V was developed. A pilot plant with an installed capacity for processing 7 ton-

nes of 4 in. wide plain aluminium foil rolls per annum has been installed.

A new air-depolarized (AD) battery of 8.4 V open circuit voltage, 50 A-hr capacity, comprising six individual AD cells connected in series, has been fabricated. The cell consists of metal reinforced tubular porous carbon cathode element, amalgamated zinc anode and a solid alkaline electrolyte to be activated by the addition of water at the time of use. Such a structure facilitates maximum air-depolarization and arrangement of cells to get the desired voltage (in multiples of 1.4) from a powerpack system. Work on Sarah Beacon battery, meant for use by the Air Force during emergency, was completed. Excepting for the lower voltage operation, magnesium-lead chloride battery system has been found to be highly competitive to other existing activated battery systems. Maintenance-free lead cells of 4 V, 2.5 A-hr capacity were fabricated with immobilized gel electrolyte of one particular composition and tested for 20-hr rate capacity and for capacities at different rates of discharge at room temperature. The cells were found to give the same capacity as of foreign make.

In the field of corrosion, an important achievement was the development of an inhibitor for water supply systems. Based on Calgon, zinc and magnesium salts, the inhibitor is highly effective in the prevention of corrosion of steel and other metals in water

supply systems. A red lead-red oxide primer, used for the protection of steel structures exposed to air, has been developed with low percentage of red lead (imported) in the primer. This successfully replaces the hitherto used red lead primers and conforms to IS : 102.

A method for the production of copper powder from copper sheets has been developed. It consists in the electrolysis of copper sulphate solution containing sulphuric acid. Copper powder was produced in a bench scale unit (capacity, 1.5 kg/8 hr) and found suitable for powder metallurgical, antifouling and organic reduction applications. A method has also been worked out to retain the stability of the powder for more than a year under storage. Other important projects in the field of electrothermics and electro-metallurgy were concerned with recovery of gallium from sodium aluminate liquors, recovery of zinc from galvanizer's ash, production of calcium silicide, and utilization of waste alumina slag powder from aluminium foundries for the production of fused alumina.

An electrolytic process for the production of potassium chlorate worked out by the institute employs graphite substrate lead dioxide deposited anode (thickness of deposit 2-4 mm) and stainless steel cathodes for the conversion of sodium chloride solution to sodium chlorate. Sodium chlorate is then converted to potassium chlorate by metathesis. Two cells of 200 A and 800 A capacity were operated. Longer life of lead dioxide anode and higher current efficiency are the advantages over the conventional process.

Development of a process for the chemical polishing of copper was a major achievement in the field of metal finishing. The process consists in treating copper in a solution containing alkali metal dichromate and sulphuric acid in suitable concentration with an inhibitor (triazole group) for 5-60 s at 30-80 C. The process is not sensitive to water and no drying is necessary before polishing and hence lends itself to continuous operation. It is specially

suitable for polishing of small articles of complicated shape or articles with an intricate embossed design which cannot be mechanically polished.

Based on the know-how worked out by the institute, trial production of sodium metal, calcium gluconate and nickel-cadmium button cells was started. Know-how relating to the following four new processes/products was released to industry: cadmium sulphide photoconductive cells; lead-acid batteries; etching of aluminium foil for electrolytic capacitors; and copper plating of stainless steel. Know-how for the following three

processes/products developed by the institute was ready for release: anodic phosphating of mild steel tubes and of small parts; chemical polishing of copper; and red lead-red oxide primers.

Twenty-one patents were filed and 71 research papers and 15 review papers were published during the year.

Three CECRI processes, viz. preparation of lead dioxide electrodes for electrolysis, solder and flux for jointing aluminium cables, and electrolytic production of succinic acid received awards from the Inventions Promotion Board.

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

Chrome Tan Crystals SB & SBO

Chrome tan crystals SB and SBO are masked chrome tanning compounds by the use of which the basicity of the chrome tanning bath gets automatically adjusted as the tanning progresses. Once tanned by these materials, the leathers do not need further basification or neutralization. The use of these tanning compounds has the following advantages: (1) mild initial tanning action ensuring fine and smooth grain; (2) freedom from supervision during the tanning stage and elimination of the need for basification and/or masking, thus avoiding pH control; (3) uniform distribution and fixation of chrome throughout the thickness of leather with better absorption and utilization of chrome, minimizing the chrome content in spent bath; and (4) desired fullness and uniformly light colour of the tanned leather.

At present, tanners use ordinary unbasified chrome tanning crystals or liquors which require addition of alkali in the drum during chrome tanning process, involving time, labour and risk of uneven chrome distribution, drawn grain and uneven colour. Because the chrome tan crystals SB and SBO are basified by themselves, addition of alkali is unnecessary, thus

eliminating extra time, labour and risk to the product quality.

The estimated demand for chrome tanning compounds is 5000 to 10 000 tonnes in 1973-74. The demand is likely to increase because of the increasing interest being shown by the tanning trade in chrome and retanning technology to satisfy domestic and export markets.

After completing the work on a laboratory scale the Central Leather Research Institute (CLRI), Madras, has carried out several pilot plant trials. The products have been tested for tanning of semi-commercial lots with consistent results. The tanned and finished leathers were found to be acceptable to the customers.

The process consists of: (i) reduction of sodium dichromate into basic chromium sulphate at predetermined basicity; (ii) preparation of the powdered crystal by drum drying; and (iii) masking and basification for obtaining self-basified powder extract.

The preparation of the above mix chrome tan crystals SB and SBO constitutes one process up to the stage of preparation of predetermined basicity, say 3.5% basic chrome sulphate. After this stage, varying treatments are necessary to make two distinct products,

viz. chrome tan crystal SB and chrome tan crystal SBO.

The main raw materials required are: sodium dichromate, sulphuric acid, molasses, sodium and calcium carbonate, sodium bicarbonate, sodium hexametaphosphate, sodium sulphate, sodium phthalate,[§] sodium lactate and sodium acetate. All are available indigenously.

The main items of equipment required are: lead-lined reaction vessel, drum drier, powder mixer, platform, balance, pump, tanks and material handling equipment. All these are available indigenously.

The capacity of the minimum economic unit, as suggested by the laboratory, is about 300 tonnes per year. The investment for such a plant is estimated at Rs 7.5 lakh (excluding cost of land and building), comprising a sum of Rs 5.00 lakh on plant and machinery, and Rs 2.50 lakh as working capital. The land required for storage and manufacture is about 5000 m². The cost of production is estimated at Rs 2250 per tonne of chrome crystal SB and Rs 2800 per tonne of chrome crystal SBO.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Copper-Lead and Leaded Bronze: Bimetallic Powders

Bimetallic powders, also called pre-alloyed powders, of the copper-lead and leaded-bronze varieties are widely used for the production of sintered bearings required in internal combustion engines and other related applications. These powders should conform to the stringent specifications in respect of composition, apparent density, flowability, particle shape and screen analysis in order to yield sintered products of desired quality.

While no Indian standards are available at present for these materials, the general range of specifications covers alloy powders of 7.5 to 31%

lead, 0.2 to 11% tin, and 69 to 89% copper. A typical powder used in manufacturing bimetallic bearings is copper-lead 70/30 containing 29 to 31% lead and the rest copper. Another typical powder is copper-tin-lead 80/19/10 containing 9 to 11% lead, 9 to 11% tin and the rest copper. Other major characteristics specified are flowability, apparent density and sieve analysis.

These bimetallic powders can be made to a wide range of user's specifications by the process developed at the National Metallurgical Laboratory (NML), Jamshedpur. The non-ferrous, pre-alloyed powders are prepared by a process of atomization, wherein a stream of molten pre-alloyed metal is atomized by a stream of pressurized fluid.

The entire requirements of this material are being imported. While exact figures are not available, it is anticipated that several plants producing 1000 kg per day (single shift) will be economically viable and the product will find a ready market for the manufacture of sintered bearings. Considerable scope exists for the export either of the pre-alloyed powders or of the finished sintered products.

The bimetallic powders produced have been found comparable to imported powders of equivalent specifications.

Most of the raw materials required are available indigenously. Copper and lead are indigenously available, and tin can be purchased locally or imported by actual users.

For a 1000-kg per day plant, i.e. up to 300 tonnes per annum, the estimated requirements are as follows (allowing up to 5% manufacturing losses):

- (i) Copper-lead powders, which will form the bulk of production (up to 200 tonnes per annum), will require up to 55 tonnes of lead, one tonne of tin and 254 tonnes of copper per year.
- (ii) Leaded bronze powders, which will be produced up to 100 tonnes per year,

will require up to 11 tonnes of tin, 11 tonnes of lead and 83 tonnes of copper per year.

The basic equipment required for the integrated production of bimetallic pre-alloyed copper-lead and leaded bronze powders include raw materials storage facilities, melting units, metering arrangements, atomization unit, dewatering and drying equipment, sieve separation and blending equipment, sieve analysis and other process control media and packing/dispatch arrangements.

The equipment can be designed and fabricated indigenously. The laboratory can supply the complete engineering details (detailed project report and necessary follow-up project engineering services) for 1000 kg per day (or higher capacity) units.

The basic equipment for a 1000-kg per day unit is expected to cost about Rs 6 lakh (exclusive of land and buildings). Some 300 m² of covered area will be required. The average cost of conversion is expected to be about Rs 2.00 per kg of the product.

Units for production of bimetallic powders can be set up at any location such as light or medium scale industrial estates, as the space, power and other utility requirements are modest. Neither the handling of the raw materials/products nor the shipping of the product is complicated.

Location of a unit near the market for the product is preferable. Installation as a captive unit in a sintered products plant will contribute to the overall economics.

Interested entrepreneurs will be given full process details and general engineering data for the production unit through the National Research Development Corporation of India (NRDC). Process demonstration will also be arranged at NML for NRDC licencees.

The laboratory can also provide a comprehensive project report containing detailed equipment design and specifications, plant layouts, staff organization, cost estimates and analysis,

and general civil engineering requirements.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Fatty Alcohols

Fatty alcohols find a wide range of applications, such as in the preparation of synthetic detergents, cosmetics, anti-foaming agents, plasticizers, oil and wax formulations, and evaporation retardants.

Fatty alcohols are not known to be produced in the country and the entire demand is met by imports. The annual requirement of fatty alcohols in the country is estimated at 1000 tonnes.

The Regional Research Laboratory, Hyderabad, has developed a continuous process for the hydrogenolysis of oils to corresponding alcohols at a comparatively lower working pressure than required in the conventional methods. The process consists in passing a co-current stream of hydrogen and coconut oil mixture through a fixed catalyst bed maintained at reaction temperature. The product alcohols are separated from the gas stream in a separator from which the gas is recycled into the system. The separated alcohols after being dried are distilled under vacuum into lower and higher boiling fractions. Some of the distinct advantages of the process, apart from employing pressures lower than in the conventional methods, are that: (i) the process can be easily extended to other raw materials, viz. oil other than coconut oil, fatty esters and fatty acids, with some modifications in the reaction conditions; and (ii) only small quantities of catalyst are needed as it is active for many hours of operation.

The process has been studied on a pilot plant scale of 17 litres per day. The plant was operated for about a year. The yields were 80-85% based on oil weight.

The main byproduct obtained from oil hydrogenolysis is iso-propanol. It

appears practicable to recover about 75 kg iso-propanol per tonne of fatty alcohols.

The main raw materials needed in the process are coconut oil, catalyst and hydrogen, and all these are available indigenously.

Various items of plant and machinery needed include: fatty oil storage farm, oil metering pump, gas compressor, low pressure hydrogen storage, high pressure hydrogen storage, heat exchanger, reactors, preheater, cooler, high pressure gas/liquid separator, low pressure gas/liquid separator, trap, gas drier, gas recirculating pump, vacuum drier, batch distillation still with packed column, reflux condenser, ejector (steam) installations, boiler for steam generation, and cooling tower.

The total investment for setting up a plant of 300 tonnes per annum capacity has been estimated at Rs 27.78 lakh, including a working capital Rs 10.77 lakh.

Further particulars may be obtained from: Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

DC Chopper Amplifier

The problem involved in amplifying small dc signal by means of either a valve or transistor circuit is well-known. Direct current amplifier for direct amplification of small signal suffers from instability and for this reason, dc signals are not directly amplified in applications where long-time stability is essentially required. Usually dc is chopped in order to convert it into ac signal either by a mechanical chopper or by using transistor switch. There are several advantages and disadvantages in both types of chopper. But, because of technical difficulties, mechanical choppers have not been produced in India till now. The replacement of a mechanical chopper by a suitably designed transistor switch has been tried successfully in many parts of the world and the transistor switches for this purpose are

available commercially in advanced countries. In India such switches have not yet been manufactured, particularly for very low level dc signals. The dc chopper amplifier contains a properly corrected transistor switch and a stable ac amplifier and with this combination high stability has been obtained. This type of dc amplifier will find many applications where systems require dc amplifiers particularly for the amplification of thermo-emf. It has a stability of $\pm 5 \mu\text{V}$ in a day, sensitivity $200 \mu\text{V}$ input signal for full-scale deflection and linearity within 1%.

A prototype has been fabricated by the Central Mechanical Engineering Research Institute (CMERI), Durgapur, and is in use.

At present, the bulk of the demand for the chopper type dc amplifier is met by importing the essential components. The amplifier developed by CMERI will replace the amplifier containing imported components.

The essential components required are transistors, resistors, capacitors, and meters, and all these are available indigenously. No special type of device is required for manufacturing such a type of unit. The cost of the prototype is Rs 1000 and the market price is estimated at Rs 1500.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Glass-Ceramic Materials

A glass-ceramic material has been developed by the Central Glass & Ceramic Research Institute (CGCRI), Calcutta, for the production of industrial jewels, textile ceramics and certain common articles which are required to possess high mechanical strength, hardness, chemical durability and electrical resistance. Jewel bearings are used in measuring instruments and thread guides in textile industry. Although the exact data regarding the present demand for jewels in India are not available, it is assumed that there

is substantial demand for textile ceramics and industrial jewels. At present, industrial jewels are made out of sapphire and the process is expensive. Abrasion-resistant textile ceramics are being imported.

The process developed by CGCRI consists of melting the raw materials to a homogeneous glass at temperatures not exceeding 1450°C. Articles are then fabricated out of the molten glass by blowing, drawing, casting and sometimes by pressing. The articles are heat-treated at a temperature below 1000°C. The laboratory investigations were conducted on 10 kg of glass at a time. The articles fabricated in the laboratory, ranging in colour from almost white to light blue to grey to light cream and dull red, possess high chemical resistance to acids and alkalis, especially the latter. The characteristics of the laboratory product are as follows :

Density	: 2.90-3.05 g/cm ³
dc Resistivity	: 1014 ohm-cm (at room temp.)
Power factor	
(at 1 Mc/s)	: 0.0015
Dielectric constant	: 17
Modulus of rupture	: 50 000-60 000 psi
Hardness (Mohs)	: up to 8

Sand, clays, magnesium-bearing minerals, and minerals used as nucleating agents are the main raw materials required for the manufacture of the glass-ceramic material. All these are available indigenously.

Pot furnaces complete with blower, burner and pipe fittings, electrical furnaces for annealing and controlled crystallization, press machine, moulds, and grinding wheel are the important items of plant and machinery. All these are available indigenously.

The laboratory has assumed 7.50 tonnes per annum as the economic capacity of the plant for the manufacture of glass-ceramics. The capital outlay for a plant of this size has been estimated at Rs 1 84 400 (Rs 1 43 000 as fixed capital on plant and machinery

and Rs 41 400 as working capital). The cost of production of the material has been estimated at about Rs 22.45 per kg.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Preparation and Formation of Waxil Emulsions

The leather goods industry uses annually about 50 tonnes of conventional wax emulsion, and while making this emulsion, the manufacturers face the problem of 'foaming'. To overcome the problem of 'foaming' and to get better glaze, slip and antitack feel on the leather surface, a new process has been developed by the Central Leather Research Institute (CLRI), Madras. The process consists in melting wax (shellac or carnauba wax) with triethanolamine and an emulsifying agent. An organometallic compound is added to the molten material and the melt is stirred well. The equipment used is a stainless steel jacketed vessel with a high-speed stirring arrangement.

The waxil emulsion has been produced in a pilot plant of about 150 kg per day capacity. The advantages of the process are that such problems as foaming and agglomeration are avoided and the emulsion produces easy slip and antitack feel, and gives better glazing properties.

Any manufacturer of leather auxiliaries can make the new waxil emulsion with no extra capital but with a small working capital of less than Rs 1000. The raw materials, viz. shellac wax, triethanolamine, surfactant (emulsifier), and organometallic compounds, are available indigenously. For making carnauba wax emulsion, the wax has to be imported. While the cost of carnauba wax is around Rs 18 per kg, the cost of shellac wax is only Rs 8 to 10 per kg. One kilogram of the product can be made at a cost of about Rs 5.60 and the profitability is expected to be high.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Triphenyl and Tricresyl Phosphate

Triphenyl phosphate is an important plasticizer used in photo film industries, and tricresyl phosphate is used in plastics and synthetic film industries. According to the information available these compounds are not being manufactured in the country and the entire requirement is met through imports. The Hindustan Photo Film are importing triphenyl phosphate to the extent of 200 tonnes per annum. The requirement of tricresyl phosphate is estimated at 300 tonnes per annum.

At the instance of Hindustan Photo Film, Ootacamund, the Regional Research Laboratory (RRL), Jorhat, took up investigations on the development processes for the production of triphenyl phosphate and tricresyl phosphate. The laboratory has successfully developed processes for both the chemicals. Triphenyl phosphate is produced by reacting phenol with phosphorus oxychloride. Cresyl phosphate is prepared by substituting cresol mixture from coke ovens in place of phenol. The reaction gives 80-85% yield of triphenyl and tricresyl phosphate. The process has been standardized on 1 kg per batch scale. The product prepared by laboratory has been tested by Hindustan Photo Film, and found satisfactory.

Phenol, cresol mixture and phosphorus oxychloride are the major raw materials required for the manufacture of the two compounds. Phenol is manufactured in the country by a few firms while cresol mixture is available in adequate quantities as coke oven byproduct. Phosphorus oxychloride is also being produced indigenously by a couple of firms.

Glass-lined reaction vessel, porcelain condenser, thermic fluid boiler, vacuum pump, crystallizer, drying oven, and heat exchanger are the main items of

plant and equipment. All these can be fabricated indigenously.

The total capital outlay for a plant capable of producing 30 tonnes of triphenyl phosphate per annum is estimated at Rs 2.25 lakh (Rs 1.5 lakh as fixed capital on plant and equipment, and Rs 75 000 as working capital). The cost of production of triphenyl phosphate is Rs 11.40 per kg

as against the market price of Rs 20-24 per kg; the cost of production of tricresyl phosphate comes to Rs 9.70 per kg as against the market price of Rs 18.20 per kg.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

CSIR SUPPORT TO RESEARCH

Completed Schemes Ionospheric Absorption of Radio Waves

Under a CSIR-supported research scheme which operated at the Department of Physics, University School of Sciences, Gujarat University, Ahmedabad, from Sept. 1969 to Aug. 1972, Shri B. M. Patel (a CSIR research fellow) and Dr K.M. Kotadia (principal investigator) carried out the following studies: (i) analysis of the ionospheric absorption data recorded at Ahmedabad; (ii) winter anomaly in ionospheric absorption at midlatitudes; and (iii) solar radio bursts, magnetic activity and short-wave field strengths.

Preliminary analysis of the ionospheric absorption data recorded at Ahmedabad (23°01' N, 72°36' E, magnetic dip 34°N) by Al method shows that the absorption L on the average in equinoxes of 1972 varies from 30 db to a maximum of 70 db during the course of a day (0800-1700 hrs) on frequency 1.8 MHz, 25 db to 60 db on 2.2 MHz, and 20 db to 55 db on 2.5 MHz. The index n in the relation $L=L_0 \cos^n \chi$ is found from the diurnal variation to be 0.88 for 1.8 MHz, 0.94 for 2.2 MHz, and 0.97 for 2.5 MHz. There is some seasonal variation also in the value of n .

Studies on winter anomaly on ionospheric absorption at midlatitudes were carried out for a half solar cycle 1964-1969. It was found that the day-to-day variability in winter is very large compared to that in summer, but its correlation with the 10 mB-level temperature is not good. Also, the

anomalous changes in absorption in one winter differ significantly from those in another winter. From the extensive study on five different frequencies it has been concluded that the winter anomaly arises from the changes in the gas composition in the D and E regions of the ionosphere associated with the changes in the wind structure in the lower atmosphere, say at lower mesospheric levels.

Short-wave radio signal strengths received from Colombo on 11.8 MHz have given some interesting data relating to solar radio bursts and magnetic storms. Sometimes temporary short-lived enhancements of field-strengths are observed during night-time following solar radio bursts. No definite explanation is yet available but it is felt that some travelling irregularity excited by the burst in the F2-layer of the ionosphere might cause the temporary increase of signal strength. During magnetic storms, the flutter fading, believed to be due to spread-F, is very much reduced and there is a black-out at the time of severe magnetic storm activity.

Other studies made in the research scheme include the lunar tidal variation of ionospheric absorption on different frequencies, and solar cycle variation in the amount of absorption.

Development of High Temperature Materials: Sintering Characteristics of Molybdenum-Base Binary Alloys

The effect of compacting pressure (range, 6-13 tonnes/cm²) on the sintering behaviour of Mo-Al alloy (4% by

weight of Mo) and Mo-Cu alloy (2% by weight of Mo) has been investigated by Shri M. Lal, a CSIR research fellow, who carried out research under the guidance of Prof. G. S. Upadhyaya at the University of Roorkee, Roorkee. In the case of Mo-Al alloy, liquid phase sintering was carried out at a temperature of 750°C for 30 min and in the case of Mo-Cu alloy, sintering was carried out at a temperature of 900°C for 4 hr; in both the cases a vacuum of the order of 5 μ was maintained. In the case of Mo-Al alloy, with increase in compacting pressure the percentage change in density decreased and showed a maximum decrease at a compacting pressure of 9.86 tonnes/cm². In the case of Mo-Cu alloy, with increase in compacting pressure initially the percentage change in density decreased and then increased insignificantly.

For both the alloys it is observed that with the increase of compacting pressure the hardness (VPN) increases. The hardness values of Mo-Cu specimens are higher than those of the Mo-Al specimens. As the density plot does not follow a parallel sequence with that of hardness, it is concluded that alloying of components is in progress, which naturally increases with compacting pressure, since more area of contacts is now available to promote diffusion.

Ultimate Strength of Two-way Post-tensioned Prestressed Concrete Slabs under Static Loading

A theoretical study of the strength and behaviour of two-way post-tensioned prestressed concrete slabs under static loading followed by an experimental investigation has been made by Shri T. S. Ramakrishnan (principal investigator) and Shri S. C. Natesan (co-principal investigator) in P. S. G. College of Technology, Coimbatore, during the period Aug. 1970 to Oct. 1972. The following are the main conclusions of the study:

1. The elastic plate theory may be used satisfactorily to predict the behaviour

of a prestressed concrete slab loaded within the elastic range.

2. The cracking load has little practical significance since the initial cracking is localized at the points of high moment. The slab can sustain large increases in load before widespread cracking takes place.

3. Sufficiently accurate limit loads can be predicted by Johansen's yield line theory for prestressed concrete slabs. The experimental loads are higher than Johansen's value as is the case with reinforced concrete slab.

4. The initial cracking load varies in accordance with the loading pattern and lies between 50 and 60% of the ultimate load. Instability and loss of rigidity occur in the prestressed slabs when the prestress is small compared to the modulus of rupture.

5. The yield line patterns in prestressed concrete slabs are not only dictated by geometry, end conditions and loading patterns but also by contiguity of the zones to the load points.

6. The yield pattern is characterized by a few numbers of greater width as against a large number of cracks comparatively smaller width in reinforced concrete slabs.

Rapid Methods of Chemical Analysis and Quality Control in Cement Industry

In its special publication (SP 5) issued in April 1973 the Cement Research Institute of India (CRI), Bhallabgarh, presents a resume of theory lectures and tutorials given to the trainees of a training course organized by the institute (13-25 November 1973) on the application of complexometric (EDTA) and instrumental (colorimetric and turbidimetric) methods for the rapid chemical analysis of cement and its raw materials. Methods of chemical analysis developed and/or standardized by CRI are dealt with in one of the chapters. The estimation of the major and minor oxides commonly occurring in cement and its raw mate-

rials is of particular interest to the analyst in cement industry.

The 74-page publication is expected to not only provide a record of the training course but also to serve as a reference book for working analysts in the field of cement manufacture. Enquiries regarding the publication may be addressed to: The Director, Cement Research Institute of India, M-10 South Extension II, New Delhi 110049.

Seminar on Electrochemistry

The fourteenth seminar on electrochemistry will be held from 21 to 24 November 1973 at the Central Electrochemical Research Institute, Karaikudi. Original and review papers on any branch of electrochemistry under the following seven sections may be submitted for presentation at the seminar: (1) Electrodeposition and metal finishing; (2) Batteries; (3) Electroorganic and electro-inorganic products; (4) Electrothermics and electrometallurgy; (5) Electrode kinetics, electrochemical equilibria and electroanalysis; (6) Corrosion and its prevention; and (7) Solid state electrochemistry.

The last date for the receipt of both abstracts and full papers is 31 July 1973. Further information may be obtained from Dr V. K. Venkatesan, Convenor, Central Electrochemical Research Institute, Karaikudi 623003.

PATENTS ACCEPTED

Indian Pat. 131020

Improvements in or relating to deashing of natural graphite at high temperatures
R. Seth, S. Ghose, A. Biswas & A. Lahiri
CFRI, Dhanbad

In the hitherto known processes for deashing of natural graphite of high ash content (15-20%), the graphite sample is treated with alkali at temperatures around 600°C and the duration of treatment extends till the reaction with the mineral present in graphite is complete in the fused state. The fused mass on being cooled sticks hard to the container in which the

reaction is carried out and the recovery of the deashed graphite poses considerable difficulties. In the process covered by the patent, deashed graphite can be recovered without any damage to the reaction vessel.

Powdered graphite sample is thoroughly mixed with excess sodium hydroxide and heated in a suitable container. The fused mass of graphite and sodium hydroxide is collected in the form of lumps which are finally leached with hydrochloric acid to make them iron-free. The resultant graphite has an ash content of less than 0.3% and can be used for making carbon and graphite products.

PATENTS FILED

2255/72 : Improvements in or relating to a process for the extraction of nickel and cobalt from lateritic ores by acid leaching, P. K. Rao, S. C. Panda, D. N. Dey, R. K. Sahu & P. K. Jena—RRL, Bhubaneswar.

2256/72 : A technique of constructing thin, impermeable cut-off walls, D. Mohan, A. G. Dastidar, K. G. R. S. Jain, R. L. Makol & R. C. Jain—CBRI, Roorkee.

2257/72 : Improvements in and relating to uniform current distribution in electrolytic cells for electrofinishing processes, B. A. Shenoï & R. Subramanian—CECRI, Karaikudi.

PATENTS SEALED

122347 : Improvements in or relating to heart beat rate measuring instrument, R. Parameswaraiah & P. E. Sankaranarayanan—NAL, Bangalore.

122692 : An apparatus for cracking silicon tetraiodide, F. Kiss, V. K. Amar & P. K. Gupta—NPL, New Delhi.

122718 : Automatic lubricator for winding wire rope in service, A. K. Dutta, M. N. Tarafdar & P. Roy—CMRS, Dhanbad.

122862 : An apparatus to study Bragg diffraction, V. N. Bindal—NPL, New Delhi.



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Deep Seismic Sounding Study of Earth's Crust

Indo-Soviet Collaboration Project at NGRI

A long-range project to study earth's crust in India has been launched by the National Geophysical Research Institute (NGRI), Hyderabad. The technique employed is known as deep seismic sounding (DSS)—the latest and most efficient geophysical technique to study fine structure of the crust and upper layers of the mantle up to 80-100 km depths.

DSS studies can help in the determination of the shape of boundaries of rocks of different elasticity and delineation of deep faults which serve as migration channels for the magma to the zones of depositions. As a rule, distribution of ore deposits is controlled by the disposition of deep fault and fracture zones in the earth's crust and upper mantle. These studies can, therefore, result in the formulation of revised geological principles governing the distribution of economic minerals and may help find entirely new mineralogical provinces. The method is of strategic importance because of the increasing demands for minerals, energy sources, etc.

The technique involves generation of seismic waves by setting off underground chemical explosions and recording deep travelling waves bounced off deep-seated geological structures at a number of points along a chosen profile on the surface of the ground. These waves are recorded photographically as well as on magnetic tapes which are processed and interpreted to obtain detailed geologic structure. The explosions (shots) are made at a number

of points along a chosen profile in a region to gather adequate seismic data. Two methods are generally employed : (i) continuous profile coverage, and (ii) point sounding coverage. Frequencies of 3-20 Hz are used in deep seismic sounding. The technique of data processing and interpretation is highly complicated, requiring expertise and experienced manpower. The field equipment is sophisticated and quite expensive. The technique has been developed and employed so far only in a few countries like USSR and USA.

Under an Indo-Soviet collaboration agreement executed in 1972, the DSS project was formally inaugurated on 9 December 1972 at NGRI, the main implementing organization in India. Started with Soviet assistance, the project is under way with USSR collaboration. After three years of joint studies, the work on the project will be carried out by NGRI. Academician S. I. Subbotin of the Ukrainian Academy of Sciences, USSR, and Dr Hari Narain, Director, NGRI, are project coordinators for USSR and India respectively.

The main objective of the project is to determine the crustal structure in different geological regions of India by determining velocities in various crustal layers down to the Mohorovicic boundary. It is also proposed to :

(1) correlate deep and surface structures which can be of practical value for mineral exploration;

(2) explore geological features governing the formation and distribution of ores and non-ore minerals;

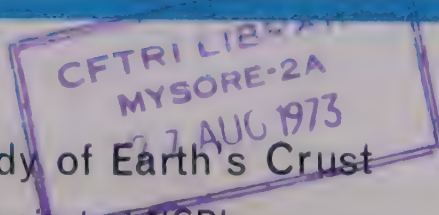
(3) establish the exact nature of gravitational and magnetic anomalies which can lead to their syllogistic interpretation with the help of DSS studies. This may help in estimating the extent of various sedimentary basins where oil may be found by the use of gravity and magnetic data alone; and

(4) locate deep-seated faults and various fault blocks in their proper tectonic setting to arrive at the exact status of seismicity in the various parts of the country.

In the first phase, a 600-km long transpeninsular profile running from Kavali (Nellore dist., Andhra Pradesh) on the east coast to Udipi (Mysore) on the west coast was selected. A reconnaissance field survey was jointly carried out by Indian and Soviet scientists along the DSS profile to select shot points. The field camp was established near Kavali town and the inaugural DSS shots were fired on 25 December 1972. During the field season (December 1972 to March 1973), 200 km of the eastern Kavali-Udipi profile were covered. Two mobile seismic recording units using 9 shot points 0, 40, 80, 100, 120, 140, 180, 210 and 225 yielded about 1000 line km of travel-time curves.

Preliminary interpretation of the seismograms revealed (i) the depth of the Cuddapah basin to range from 5 to 8 km; and (ii) depths to 'Conrad' and 'Moho' boundaries in the area to be at 20-26 km and 42-45 km respectively.

The Indian organizations collaborating in the project are the Oil and Natural Gas Commission, Geological Survey of India, India Meteorological



Department, Osmania University and the Central Water & Power Research Station.

The middle part of the Kavali-Udipi profile is proposed to be shot in the field season 1972-73. Other profiles recommended by Unesco expert are : (i) east-west profile along lat. $19^{\circ} 15' N$ from long. $70^{\circ} E$ to $74^{\circ} E$; (ii) east-west profile from the continental-shelf through Koyna to Hyderabad (includes both the cover of Deccan volcanics and the concealed basement) ; and (iii) north-south profile down long. $78^{\circ} E$ from Dehra Dun to near Hyderabad.

The Inter-Union Commission of Geodynamics Working Group 3 (B) has recommended multi-disciplinary geotraverses including DSS studies along critical zones, viz. Kashmir and Himachal Himalaya traverse, Kumaon Garhwal and western Nepal traverse, Central Nepal traverse, eastern Arunachal Pradesh traverse. Work will be taken up according to national and scientific priorities.

Danish Assistance for Establishment of Abattoir at Mysore : India and Denmark Sign Agreement

The Government of Denmark will help India establish a modern abattoir at Mysore as an important step towards modernization of slaughter houses in India. An agreement to this effect was signed in New Delhi on 28 June 1973 between the Governments of India and Denmark. The Danish Ambassador in India, His Excellency Henning Halck, signed the agreement on behalf of the Government of Denmark and Shri K. G. Krishnamurthi, Secretary, Council of Scientific and Industrial Research, on behalf of the Government of India. The agreement will remain in force for a period of two years in the first instance.

Through this agreement the Government of Denmark will provide equipment and spare parts worth Rs 10 lakh for a modern abattoir to be established at the Central Food Tech-

nological Research Institute, Mysore. This abattoir will serve as a model for future construction of slaughter houses in other cities of India on scientific lines. It will also serve as a research and training centre for persons from slaughter houses of other cities in India. The Government of Denmark will also provide fellowships of six

months' duration tenable in Denmark to two Indians employed at CFTRI for training in abattoir technology.

The Government of India will provide the site and buildings for the proposed abattoir at Mysore and will be responsible for the installation and maintenance of machinery and equipment.

PROGRESS REPORTS

RRL, Jammu Report : 1970-71

The report of the Regional Research Laboratory (RRL), Jammu for 1970-71, published recently, shows that the laboratory, having built up a fine infrastructure for industrial research earlier, has attained the take-off stage. A branch laboratory at Srinagar concerned with cytogenetics, plant breeding, economic plants and mushrooms was inaugurated during the period.

Pilot scale cultivation of ergot at the laboratory's experimental farm at Chatha (Jammu) yielded 5.68 quintals of ergot from 3.4 ha — a yield considerably higher compared to the yields obtained in previous years and higher than the international standard. A process for the preparation of ergotamine tartrate was worked out. Tablets of ergotamine tartrate have been produced in the Drug Research Laboratory, Jammu, and are available on commercial scale.

An economic method for the production of hyoscyne hydrobromide from the seeds of *Datura innoxia* and *D. metel* was developed and the process was passed on to Drug Factory (CIMFO), Jammu, which has sold, as a trial lot, 500 g of hyoscyne. A process for the manufacture of hyoscyne (scopolamine) hydrobromide from *D. stramonium* was also developed. This process is applicable to the species in which hyoscyne occurs as a minor constituent.

Two varieties of French basil (*Ocimum basilicum*) highly priced for its oil used in perfumery, were grown on a large scale, following encouraging results from small-scale experiments.

One variety, the seeds of which were obtained from France, gave 0.5-0.6% oil on bulk distillation of leaves. It was possible to obtain 3 harvests in a year. The plant behaves as a perennial crop, and once planted, can remain productive for 3-4 years. The oil possesses a very pleasant aroma and contains about 55% linalool. The other variety, the planting material for which was obtained from Kanpur, gave 0.7% oil consisting mainly of linalool and methyl chavicol.

Attempts were made to evaluate sugarcane juice as the raw material for citric acid production. The yield was 80-90% in shake flasks and 70-80% in laboratory fermenters on the basis of the starting sugar when its concentration in the medium was 10%.

A strain of *Aspergillus niger* which converts glucose to calcium gluconate has been developed. Conditions were standardized for fermenting up to 25% glucose solution within 72 hr to give more than 90% yields on the basis of starting sugar. Fermentation of 15-20% glucose medium in 15-litre fermenters was carried out successfully within 48 hr. In 5-litre fermenters, gluconate could be produced from a 15% glucose medium within 24 hr.

Pretreatment of fresh cherries with calcium chloride was found to harden the texture and prevent their becoming too soft or mashed during processing. This eliminates losses arising during packaging and transportation.

An improved method of production of pine oil in more than 90% yield (Indian Pat. 129746) has been developed. The pine oil produced analyzes to 75% alcohols (calculated

as α -terpeniol), has a pleasant odour, and is accepted by industry at Rs 6-8 per kg.

Two processes for the preparation of concentrates containing about 25% calcium sennosides from senna pods and leaves have been developed. Sennoside samples prepared were tested for purgative activity and found comparable to Pursennid (Sandoz).

A process for the production of xanthotoxin from the furanocoumarins recovered from *Heracleum candicans* has been developed. The commercial feasibility of the process has been established at the Drug Research Laboratory, Jammu. A process for the production of the alkaloid colchicine (Indian Pat. 130445), used for inducing polyploidy in plants and in the treatment of acute gout, from *Gloriosa superba*, was developed, and scaled up to obtain 200 g lots of colchicine.

A new pyrethrum-based formulation has been prepared which when burnt gives out a steady dose of toxicants in a colloidal form having the property of quick and simultaneous action of repellency, immobilization, paralyzing and causing death to flying insects, especially mosquitoes. Its smoke is not dangerous or uncomfortable to human beings and other mammals.

Berberis lycium, the most abundantly available species in the region, was found to yield 1.9 to 2.9% berberine, which is used in the treatment of chronic spleen and liver enlargement. A commercial process for the extraction of berberine from this species was developed and worked out on pilot plant scale.

Eucalyptus citriodora, cultivated mainly for its essential oil in the laboratory farm, yielded about 4.4 tonnes of stem (0.5 to 4.0 diam. cm) per acre per harvest. Conditions for the production of paper of satisfactory quality from the wood pulp obtained from the stems have been worked out. Carboxymethyl cellulose of satisfactory quality was prepared from the nitric acid pulp of fir sawdust. The pulp was prepared on a semi-pilot scale.

The leaves and bark of *Parrotiopsis jacquemontiana* were found to be rich in tannins. Tanning trials with both the materials gave satisfactory leathers. The tannin of the leaves can be used for producing E. I. skin.

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

Extra-fine Non-ferrous Metal Powders

An atomization process for the production of extra-fine non-ferrous metal powders in the straight range has been developed by the National Metallurgical Laboratory (NML), Jamshedpur. The non-ferrous metals specifically included in this range are : aluminium, copper, lead, tin and zinc. Also included are brass (commercial Cu-Zn compositions) and bronze (commercial Cu-Sn compositions).

The fine mesh sizes extend beyond 325 mesh (44μ) with purity as desired.

The NML process can yield metal powders to the general specifications given below (more precise specifications can be obtained by suitable process adjustments for which adequate know-how will be made available) : (i) mesh sizes up to and beyond 325 mesh with sieve analysis as desired; (ii) flowability as specified; (iii) apparent densities as specified; and (iv) particle shape, spherical or irregular (depending on metal and process conditions).

These powders are at present partly imported. Some powders are being manufactured in India by electrolytic and mechanical methods. Production of metal powders by atomization is not done on a big scale in India and hence there is considerable scope for setting up a large number of small scale units of up to 2500 kg per day capacity to meet the current and projected demand for these powders. Export possibilities are also considerable.

Ancillary know-how for converting the atomized product to flaky products to specifications required in pyrotechnics, lithographics, pigments, etc. can also be provided on request.

As many as 513 identified specimens of plants of economic importance were added to the herbarium, bringing the total number of specimens to 2580, which represent 1021 genera and 139 families.

Some typical uses of atomized metal powders are given in Table 1.

TABLE 1 — TYPICAL USES OF ATOMIZED METAL POWDERS

Aluminium

Aluminium paste manufacture for pigments and paints

As catalyst; for cementation and reduction processes in fine chemicals to generate hydrogen

Cold solders

Foundry exothermics and hot tops

Metal spraying/colorizing

Powder metallurgy

Pyrotechnics — explosives, flares, fireworks, rocket propellants

Other uses — antirburn ointments, brake linings, deodorants, drain cleaner formulations, filler in synthetic resins, light-weight concrete, bitumen road surfacing

Brass and bronze

Powder metallurgy products, filters, diamond tool manufacture; conversion into lithographic and pigment grades

Copper

Motor bushes and electrical contacts, porous bronze bearings, semi-conducting polymer filler, cladding of base metals

Lead

Frictional material and metallic packing, solders

X-ray/gamma-ray shielding leaded steels

Tin

Phosphor-bronze bearings, solders

Zinc

Metal spraying/sherardizing, cementation, conversion into pigment grades

The straight non-ferrous metal powders are made by a process of atomization wherein a stream of molten pre-alloyed metal is atomized by a stream of pressurized fluid under properly controlled conditions to yield the desired mesh size, sieve analysis, particle shape and other required physical properties.

The know-how developed covers the entire manufacturing process from the

melting of the metal (raw materials) to the packing of the finished, salable metal powder product.

The powders produced will meet international standards, and by using proper control equipment, product of consistent quality can be fully ensured with minimum losses.

Copper, lead, zinc and aluminium are indigenously available. Requirements of tin may have to be imported. The actual quantitative requirements would depend on the product mix adopted to suit periodic market surveys and actual demand.

The basic equipment required for producing atomized metal powders include melting furnace, atomization unit, centrifuge, drier, blender and packing unit. Essential ancillaries include storage and materials handling facilities and quality control equipment. Optional ancillaries include those required for heat treatment and chemical treatment.

The additional equipment required for converting the atomized powders to flaky powders for lithographic and other uses include special media grinding and polishing equipment.

All the basic items of plant and equipment can be designed and fabricated indigenously and no foreign exchange is likely to be required.

The National Metallurgical Laboratory is in a position to transfer the complete technology for units up to 2500 kg per day (and above if required) in the form of a project report giving detailed design/drawings of equipment, layouts, techno-economic analysis, etc. on suitable terms and conditions.

The capital investment on basic equipment for a 2500 kg per day atomization unit would be approximately Rs 10 lakh (exclusive of land and buildings). The average cost of conversion of virgin metal to atomized powder will be around Rs 2.00 per kg of product.

The ancillary conversion unit for lithographic grades will involve an additional capital investment of up to Rs 5 lakh.

Metal powder making units can be set up at virtually any location such as light or medium scale industrial estate. The space, power and other utility requirements are modest. The location of a unit near major consumer markets is advantageous.

Space requirements for the atomization plant have been estimated as up to 400 m². The separate conversion ancillary (lithographic) will involve an additional 100 m².

Interested entrepreneurs will be given full process details and general engineering data for a 2500 kg unit or any other specified capacity unit through the National Research Development Corporation of India (NRDC). Process demonstration will also be arranged at NML for NRDC licencees.

The laboratory can also provide an advanced project report containing detailed design of equipment, layouts, staff organization, up-to-date cost estimates and analysis, and civil engineering requirements.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Silica Gel

Silica gel finds application mainly as a desiccant in various industries. Its extensive use now covers right from instruments to medicines. In all applications silica gel helps keep the atmosphere dry and thereby protects the material from corrosion, fungal growth or spoilage. Other uses of silica gel are in the separation of gases in petroleum refineries, and as a catalyst carrier in butadiene polymerization.

Once the gel is saturated with moisture, it can be regenerated by simple drying in an oven or with superheated steam. To indicate when the silica gel has attained moisture saturation, a colouring agent is sometimes incorporated in the gel which changes from blue to purple. The colouring agent generally employed is cobalt chloride which in its dehydrated form is blue

in colour but changes to purple when it absorbs moisture.

The conventional method of making silica gel involves the preparation of sodium silicate by fusion of fine grained sand or quartz with sodium carbonate, followed by digestion with water in an autoclave to get sodium silicate, or water glass. The water glass is then treated with acids to get silica gel in mixture with electrolyte. The mixture is then dialyzed to remove the electrolyte from the gel. The electrolyte-free gel is dried to a moisture content of 6-10%.

The silica gel prepared by the conventional method suffers from the following drawbacks :

- (1) If sodium silicate and acid are not properly adjusted, a gel which has not attained the maximum degree of polymerization may be obtained. This will affect the moisture absorption capacity.
- (2) As the gel is associated with considerable amounts of electrolyte, it is necessary to remove the electrolyte by dialysis, thus making the process cumbersome, inefficient and expensive.
- (3) The moisture absorption capacity of the conventional gel is only 36% at 90-95% RH.

The process developed by the Regional Research Laboratory (RRL), Jorhat, overcomes all these drawbacks. It involves the dilution of sodium silicate solution in water with desired concentration. The decationized silica sol obtained by passing sodium silicate through a bed of cation exchanger is then passed through a column packed with anion exchanger. The silica gel obtained thus is mostly free from cations and anions. On keeping, the sol is gellified to a thick gel, which is subjected to a preliminary drying at 50-60°C and final drying at 120°C in an electric oven. The gel so obtained has a purity of more than 99% and an absorption capacity of 42-44% at 90-95% RH.

Silica gel required for specialized use where high purity is one of the criteria is obtained after further processing of the gel obtained as above. The purity of gel after further treatment increases

to 99.99%. This gel can be utilized for chromatographic and other special purposes. The bulk density of the gel can be varied between 0.48 and 0.70 kg/litre; the mechanical strength can also be varied.

The process has several advantages :

- (1) It is simple and does not require elaborate arrangement for dialysis and removal of electrolytes from silica gel.
- (2) The gel prepared following the exchange method can achieve highest purity and can be utilized not only as desiccant but also for the separation of gases and in chromatographic analysis.
- (3) The gellification of the sol does not require raising of the concentration by heat treatment.
- (4) The elimination of dialysis and separation of electrolyte from the gel make the process simpler and hence the cost of the resultant gel is invariably lower.

Sodium silicate, sulphuric acid and resins are the main raw materials required for the manufacture of silica gel. All are available indigenously.

Sodium silicate tank, dilution tank, de-ionizer, filter, tank, acid storage tank, resin exchanger, gellifying vessel, drier and gel storage are the main items of plant and machinery required. All are available indigenously.

The total capital outlay for putting up a plant of 50 tonnes per annum capacity has been estimated at Rs 1.25 lakh. The cost of production has been worked out at Rs 3.40 per kg.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Waxless Carbon Paper

Carbon paper is usually produced by applying the coating composition consisting mainly of waxes and carbon black on the surface of the carbonizing tissues. The commonly used waxes are carnauba wax, microcrystalline wax and bees wax. These waxes are not reported to be produced in the country. The import of the raw materials for the manufacture of carbon paper excluding carbonizing tissue involves

considerable foreign exchange, amounting to Rs 20 to 25 lakh per year.

The present estimated demand for carbon paper is about 60 lakh boxes each containing 100 fullsize size sheets and the demand is likely to go up to about 85 lakh boxes by the end of Fourth Plan period. It is reported that six units are manufacturing carbon paper in the country.

Waxless carbon paper, contact copy paper, etc. have recently been developed in advanced countries. The Subcommittee of the Packaging and Paper Conversion Committee and the Development Council for Paper have recommended the manufacture of waxless carbon paper in the country during the Fourth Plan period. Thus, there seem to be good prospects for marketing this product.

The Regional Research Laboratory, Jorhat, has developed a solvent-based coating composition which comprises a binding agent, a plasticizer, a dye, a colour carrier, a filler, and a suitable solvent. By applying the solution on the carbonizing tissue, carbon paper can be produced. The work has been carried out on a laboratory scale. The main advantage of the process is that it eliminates the use of special waxes. The solution can be easily prepared and dries up very quickly. The sample prepared at the laboratory was evaluated by Bharat Carbon and Ribbon Co. Ltd, Bombay, and found to be satisfactory.

Dye, kaolin, toluene or xylene, mineral oil, oleic acid, and ethyl cellulose are the essential raw materials for the production of waxless carbon paper. Ethyl cellulose may have to be imported for the time being, while other materials are indigenously available.

Steam-jacketed mixing tank with stirring arrangement, vessel for making dye solution, roller mixer, coating machines including drying and winding arrangements, storage vessel, and cutting unit are the major items of plant and equipment. Except coating machines all items of equipment can be fabricated indigenously.

The total capital outlay for a plant capable of producing one tonne of waxless carbon paper per day has been estimated at Rs 26.88 lakh (Rs 6.26 lakh as fixed capital on plant and machinery and Rs 20.62 lakh as working capital). The cost of production of carbon paper comes to Rs 3 per box.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Costus Root Oil, Fructose & Chamazulene

Costus root oil is used in high grade perfumery products. Fructose and chamazulene are obtained as byproducts during the production of costus root oil. Fructose is used in pharmaceuticals while chamazulene, which possesses anti-phlogistic and other medicinal properties, is used in cosmetics. There appears to be a fairly good demand for costus root oil in foreign countries. This oil is being exported to a number of countries. Indigenous demand is limited at present but a well-organized aromatic chemicals manufacturer can organize a permanent and flourishing export trade in this oil. Likewise, figures for the demand of fructose (imported presently) are not available. The lactone mixture obtained in the process is a potential raw material for the production of chamazulene, a market for which will have to be created.

The National Chemical Laboratory (NCL), Poona, has developed a process for the manufacture of costus root oil from the roots of costus plant grown in Kashmir and Punjab. Dried costus roots are extracted with a suitable solvent. The extract is concentrated and most of the solvent is recovered. The concentrate is treated to separate the lactones and costus root oil is then purified. Exhausted roots from which costus root oil has been extracted are further extracted with ethyl alcohol. The residue is extracted with hot water to get inulin, which is hydrolyzed to fructose. The lactone mixture obtained during the process of extraction of

costus root oil is processed further to obtain chamazulene. The process has been worked out on a pilot plant of 1 kg of costus root oil per batch.

A process for the extraction (20 kg) of inulin from exhausted root powder (≈ 6 kg) has also been worked out and conversion of inulin into fructose has been studied on a scale of 200 g of fructose syrup as well as crystalline fructose. Conversion of lactone (100 g) mixture into chamazulene (4 g) has also been worked out. The product has been found to meet the required standards of the foreign companies. Previously, NCL had been selling costus root oil to dealers in UK, USA and France and to other perfumery products dealers who had appreciated the quality of the oil. One hundred kilograms of costus roots (from Punjab) will yield 1.5-1.7 kg of costus root oil, 18 kg of fructose and 60 g of chamazulene.

The process is simple in operation and no heavy equipment is required. The raw materials required are indigenously available and the solvent used can be easily recovered. The oil obtained has a good storage life and is less liable to polymerization.

The main raw materials are costus roots and the solvent. Costus plant (Hindi : Kuth) is grown in Punjab and Kashmir, and these are the only areas in India where the costus roots are available.

The major items of plant and equipments are rotary knife cutter, extraction vessel, distillation units, vacuum pumps, and refrigeration units. These can be easily fabricated in the country.

The laboratory has assumed 300 kg of costus root oil and 3045 kg of fructose per annum from Punjab costus roots or 300 kg of costus root oil and 1902 kg of fructose from Kashmir costus roots per annum as the economic capacity of the plant. The capital outlay for a plant of this size is estimated at Rs 2 lakh (Rs 1.5 lakh on plant and equipment and Rs 50 000 as working capital). The costs of production of costus root oil from Punjab

and Kashmir are about Rs 785 and Rs 745 per kg respectively. The present international price of costus root oil is Rs 1605 per kg. If the value of fructose is taken into account, the cost will come down further. Chamazulene

has not been included in costing.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

CSIR SUPPORT TO RESEARCH

Completed Schemes

Reaction Mechanisms of Stobbe and Related Reactions

The mechanistic aspects of the newly developed stereospecific Claisen/Stobbe reaction of aromatic aldehydes and methyl phenylacetate, the analogous Stobbe condensation of dimethyl homophthalate with carbonyl compounds, and the Stobbe condensation with arylidene acetophenones have been studied under a CSIR-supported research scheme at the Department of Chemistry, Nagpur University, Nagpur. The studies were made by Shri B. H. Patwardhan, a CSIR research fellow, who worked under the direction of Dr G. Bagavant of the Department. Stereochemical studies of the Stobbe reaction have also been made.

Claisen/Stobbe condensation of methyl phenylacetate with aromatic aldehydes : A mixture of *cis*- α -carboxystilbene (I, R = H) and *cis*- α -carboxymethoxystilbene (I, R = CH₃) is formed in the condensation of aromatic aldehydes and methyl phenylacetate in the presence of metal alkoxides. The *cis* configurations of the acids and esters have been determined conclusively by mixed melting points with authentic samples, and ultraviolet spectra. It has been observed that the acid is a nonhydrolytic product of the ester which is formed as a Claisen condensation product, as shown by a study of the rates of saponification of the esters, and that the ester on treatment with metal alkoxide under identical experimental conditions is recovered unchanged.

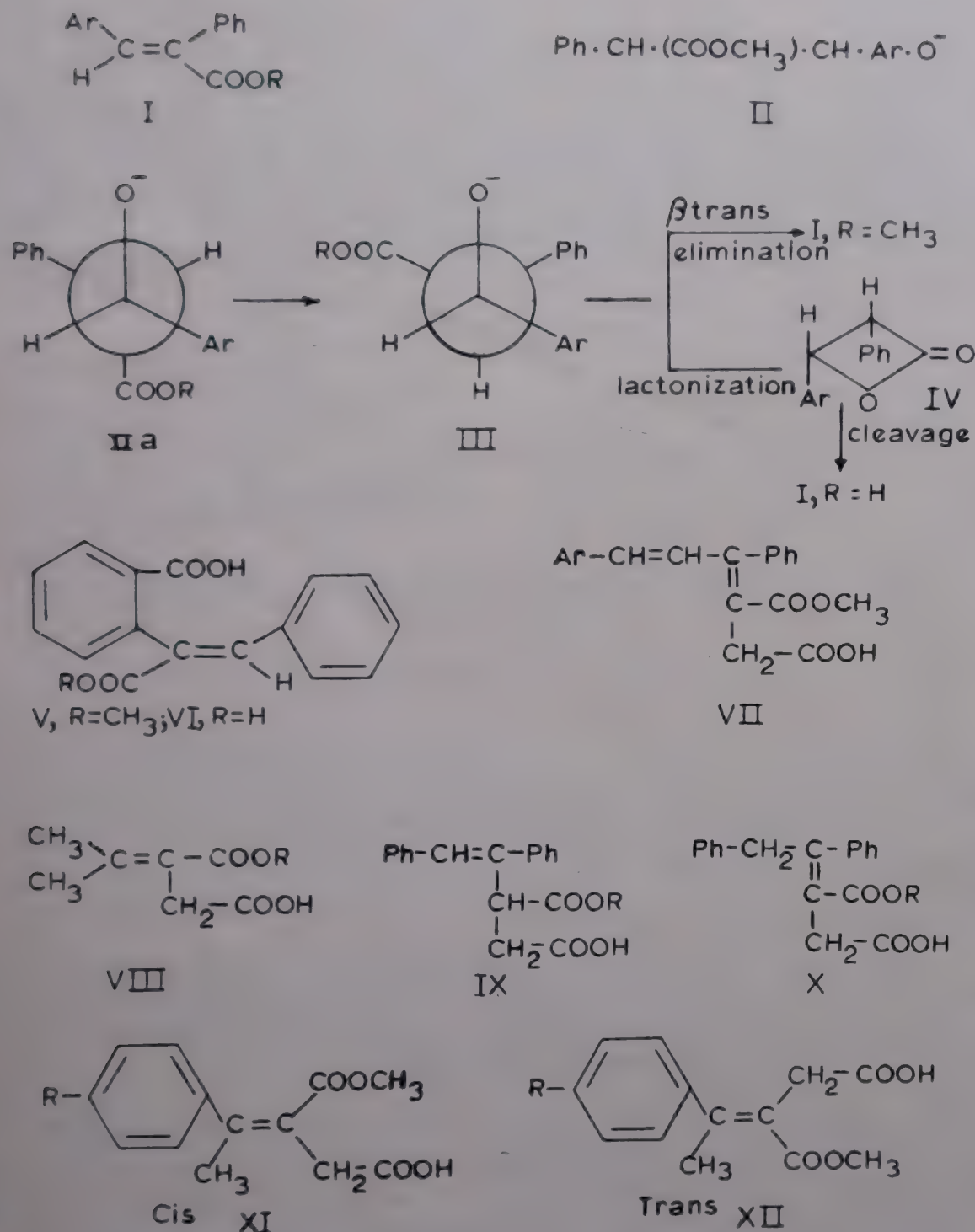
The simultaneous formation of the acid and the ester has been explained on the basis of the stability of the *erythro* form (II a) of the initially formed oxyanion (II), as compared to the

threo conformer. This anion through its rotational isomer (III) could undergo a β -*trans* elimination to give the Claisen product, the ester, or form a β -lactone (IV) which would cleave in a Stobbe type mechanism to yield the acid. Although aliphatic and aromatic ketones failed to condense with methyl phenylacetate, benzil condensed with methyl phenylacetate to give *cis*- α -carboxy- and *cis*- α -carbomethoxy- β -benzoylstilbenes in good yields.

Stobbe condensation of dimethyl homophthalate with aromatic aldehydes leads to substituted methyl α -*o*-carboxyphenylcinnamates (V) in good yields. A number of aldehydes have been condensed with dimethyl homophthalate in the presence of potassium *tert*-butoxides, and corresponding half esters (V) and diacids (VI) have been isolated. The UV spectrum of these systems is identical with that of *cis* Ph/Ph stilbenes, thereby supporting the stereochemical configuration of all these compounds as suggested earlier in the case of benzaldehyde. This stereospecific formation of *cis* Ph/Ph-COOR products has been rationalized by an argument similar to the one used for α -carboxystilbenes.

Stobbe reported a failure of Stobbe condensation of benzalacetophenone with dimethyl succinate in the presence of sodium ethoxide in ether, but it has been observed that the reaction proceeds smoothly in the presence of potassium *tert*-butoxide to yield the Stobbe products, 3-carbomethoxy-4-phenyl-6-aryl-hex-3,5-dienoic acids (VII) in 40-50% yields.

Stereochemistry of Stobbe reaction : Stobbe reaction often involves a tautomeric shift of hydrogen leading to alkylidene products. Stobbe condensation of acetone with dimethyl succinate



was carried out, and the half ester (VIII, R = CH₃) was isolated and characterized. On saponification it gave quantitatively isopropylidene succinic acid (VIII, R = H), indicating the absence of migration of the double bond.

Stobbe condensation with desoxybenzoin had been reported by earlier workers to lead to a diacid (mp 150°), to which they assigned the structure IX (R = H).

By carrying out Stobbe condensation of desoxybenzoin with dimethyl succinate under mild conditions, it was possible to isolate a half ester (mp 119°) which on saponification gave a diacid

(mp 170°). Both these products on oxidation with alkaline potassium permanganate failed to give benzaldehyde. Stobbe condensation of desoxybenzoin with dimethyl succinate under drastic conditions yielded a half ester (mp 80°) which on saponification gave a diacid (mp 94°). Both these compounds on oxidation with alkaline potassium permanganate gave benzaldehyde instantaneously.

UV and IR data as well as conversion of half ester, mp 119°, to the half ester, mp 80°, on refluxing with potassium *tert*-butoxide conclusively proved that the products formed under drastic experimental conditions have under-

gone a tautomeric shift of hydrogen and have the structure IX. The products formed under mild experimental conditions have the structure X. It is also clearly indicated that saponification does not bring about the tautomeric shift of hydrogen. The product obtained by earlier workers was found to be a mixture of diacids, mp 170° and 90°.

Stobbe condensation of acetophenone and *p*-methoxyacetophenone with dimethyl succinate leads to a stereoisomeric mixture of products (XI, XII). As several methods of estimating the correct proportion in which the isomers are formed failed, the composition of the reaction product was estimated spectrophotometrically. Pure isomers of both the products were prepared and their UV spectra were recorded. On mixing the two isomers in different ratios, different ultraviolet curves were obtained. By matching the curves with the curve for the reaction products, it was concluded that in the case of acetophenone, the ratio of *cis*-Ph/COOCH₃ (XI, R = H) isomer to the *trans* (XII, R = H) is as 60 : 40. In the case of *p*-methoxyacetophenone the ratio of *cis*-*p*-OCH₃-Ph/COOCH₃ (XI, R = OCH₃) isomer to the *trans* (XII, R = OCH₃) is as 55 : 45.

PATENTS ACCEPTED

Indian Pat. 128382

Improvements in or relating to a water vapour condenser for accelerated freeze-drying plant

B. C. Mohanty, A. Parida &
G. S. Chowdhury
RRL, Bhubaneswar

In a freeze-drying plant, where drying occurs at low pressure, high volumetric speeds are required to achieve satisfactory mass pumping rates. Refrigerated water vapour condensers, connected to the chamber, are used to freeze out the vapour load as ice, wherever such load arises. The main alternatives to such high-capacity pumping applications are multistage steam ejectors, which however have two disadvantages : non-availability and high cost of operation. On the other hand, water vapour condensers

operating in combination with mechanical vacuum pumps are economical for freeze-drying plants.

The water vapour condenser, covered by the patent, incorporates a number of novel features. Concentric-helical refrigerated coils, which are removable, are suspended inside a vertical shell by means of a rigid frame as an integral assembly. The radial spacing of coils and vertical pitch of tubes are maintained by fixing them in the frame over a number of vertical bars, which are free to take any expansion and contraction. Non-condensable gases are exhausted through a centrally located outlet, and defrosting of ice formed over coils is done by means of a defrosting device. The typical configuration of the coils in the condenser results in high vapour conductance.

Indian Pat. 130442

Process for ash reduction of natural graphite by chemical treatment in aqueous solutions

R. Seth, S. Ghose, A. Biswas & A. Lahiri
CFRI, Dhanbad

Conventional methods of deashing natural graphite of high ash content (15-20%) to a product containing less than 0.20% ash involve high temperature chemical reactions which require special equipments. In the process covered by the patent under reference, the ash content of natural graphite is reduced by chemical treatment in hot aqueous solutions of dilute acids and alkalis.

Finely ground graphite powder is heated in dilute solutions of hydrochloric acid, sodium hydroxide and hydrofluoric acid with intermittent stirring. This process eliminates most of the constituents of the mineral matter associated with the graphite. The process does not involve the use of any special equipment, is simple, and readily adaptable. Ash content can be brought down to less than 0.2%.

Electrode grade graphite can be produced from indigenous sources by the use of this process. The potential of the method is that import of special

grade low ash graphite required for making good quality carbon products can be eliminated.

Integrated Circuits and Applications

A two-week course on Integrated Circuits and Applications is being organized at Bangalore from 26 September 1973 under the joint auspices of the Indian Institute of Science and the National Aeronautical Laboratory, Bangalore. The course is designed to provide a working knowledge of electronic system design methodology using integrated circuits, and is open to working engine-

ers and engineering teachers concerned with the design of electronic systems.

The last date for the receipt of applications for registration is 15 August 1973. Further particulars may be obtained from Shri S. Rajaram, Coordinator, School of Automation, Indian Institute of Science, Bangalore 560012.

PATENTS FILED

2258/72 : Improvements in or relating to the preparation of new reactive dyes containing azido groups, N. R. Ayyangar, N. V. Badami, B. D. Tilak & E. H. Daruwalla—NCL, Poona.

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

ADVERTISEMENT NO. 12/73

It is proposed to appoint a Director to head the Regional Research Laboratory, Jorhat (Assam).

Job Requirements : It is a top research management post for one of the national laboratories of the Council of Scientific & Industrial Research. The main orientation of the work of the laboratory is towards developing technologies for the utilization of the raw materials, and agricultural and mineral resources of Assam and other north-eastern states, viz. Mizoram, Nagaland, Manipur and Arunachal Pradesh, etc. The science and technology plans of the laboratory would be reflected and dovetailed to the economic, industrial and social growth plans of the eastern region.

The laboratory has projects in the field of cellulosic materials, coal and petroleum, medicinal and aromatic plants, industrial chemicals and chemical engineering, earthquake engineering, etc. The successful candidate will be required to provide high-level leadership in the formulation of multi-disciplinary research and development programmes and projects, organizing and coordinating team work and assuring commercial utilization of the results of research. He will have the overall responsibility for the work of the laboratory and for creating an atmosphere conducive to creative work. He will be a Director of research coupled with skill in management and public relations.

Qualifications/Experience : There is no standard application form prescribed as such. The candidates must provide proof of their academic level, research and development experience and management ability consistent with the fulfilment of job requirements specified above. Scientists/technologists interested in the post may obtain from the Secretary, Council of Scientific & Industrial Research, Rafi Marg, New Delhi, a standard proforma for sending their *curriculum vitae*. They can also obtain a brochure of the aims and objects, and the latest annual report of the laboratory.

Salary/Conditions of Service : There are five salary scales ranging from Rs 1600 to Rs 3000 for the post of Directors in the national laboratories/institutes of the Council of Scientific & Industrial Research. Person selected may be fixed in any one of these scales according to individual merit.

The person selected will be appointed on contract for a period of six years, subject to confirmation of the contract after two years of satisfactory service. Other conditions of contract will be supplied on request.

Age Limit : Below 50 years, relaxable in special cases.

All correspondence in this regard may be addressed to the Secretary, Council of Scientific and Industrial Research, Rafi Marg, New Delhi 110001, and the completed *curriculum vitae* proforma must be received in this office on or before 14 September 1973.



CSIR NEWS

A FORTNIGHTLY HOUSE BULLETIN OF CSIR

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NO. 15

Bricks from Saline Soils

Saline soils, popularly known as 'kallar' soils, are generally considered unsuitable for the manufacture of building bricks. Large tracts of alluvium overlying Punjab, Haryana, Uttar Pradesh and Bihar comprise saline soils. Bricks manufactured from such soils show heavy efflorescence and scum, crumble on weathering and lose strength in course of time. When bricks made out of kallar soils are used, the surface of the walls gets disfigured and the plaster peels off quickly. When used in reinforced structures such bricks corrode the reinforcement. The Central Building Research Institute, Roorkee, has developed a process for the manufacture of good quality building bricks from kallar soils. The process has been successfully demonstrated to the industry at Kharkhoda (Rohtak), where about 1.5 lakh bricks were moulded and fired in a bull's kiln. Some of the novel features of the process are :

(1) The production of first class bricks is increased by 8 to 10%.

(2) The coal consumption for burning these bricks is 12-13 tonnes per lakh as compared to 14 tonnes for burning normal bricks.

(3) The retention of soluble salts in bricks produced by this process is reduced by 30% and no appreciable efflorescence occurs.

(4) The durability and the crushing strength of bricks are considerably improved at a slightly higher cost.

Waterproofing of Mud Walls

Millions of people in the country live in villages where most of the

houses are made of mud or sun-dried bricks. A majority of these mud houses get eroded during monsoons and need minor or major repairs every year, involving huge loss of labour and time. The Central Building Research Institute (CBRI), Roorkee, has perfected a quick, simple, cheap and effective method of waterproofing mud walls in existing mud houses. A waterproofing material based on asphalt is sprayed over the mud wall with the help of an ordinary sprayer and gets absorbed in the mud wall. The wall needs two to three sprayings which can be easily done by unskilled workers or by the villagers themselves. The absorbed material, in conjunction with clay, makes the wall surface waterproof, chalk-resistant and weather-resistant. The dark brown waterproofed mud walls can be whitewashed by adding a little adhesive in the lime wash. The waterproofed mud walls have been tested for resistance to erosion by water spray test. Waterproofing trials carried out on mud walls in a few village houses have been encouraging. The walls so waterproofed have withstood a number of heavy showers.

Unesco Conferences on Solar Energy

Dr R. L. Datta of the Central Salt & Marine Chemicals Research Institute, Bhavnagar was rapporteur at the meeting of a group of thirteen international solar energy experts who under Unesco's invitation met at Paris from 27 to 29 June 1973 to advise Unesco on the future programme of activities on solar energy. Prof. F. Trombe (France) was the chairman.

The group reviewed the entire global knowledge and the state of the art with respect to both fundamental and applied aspects of solar energy. The group concluded that there was an immediate need for a greatly expanded effort towards international cooperation in the development of pollution-free solar energy for the production of small and medium and large-capacity power of use to both developing and developed countries respectively as well as for other commodity-wise uses, and that Unesco should lead and coordinate such an effort. Unesco will undertake a programme of training courses; provide postgraduate and research fellowships; establish a clearing house; render assistance to non-governmental organizations; provide consultant missions to member states for specific projects; and set up the International Solar Energy Commission. Some of the recommendations of immediate benefit to India relate to postgraduate and research fellowships, International Congress on Solar Energy and the setting up of a Solar Energy Research Institute in the country. Other recommendations will also benefit India in a sustaining way in future.

The Board of Directors of the International Solar Energy Society (of which Dr R. L. Datta is a Director), which is responsible for organizing International Solar Energy Congresses every alternate year, has decided to hold the next congress (1975) in USA, and the one after next (1977) in India. The International Congress to be held in 1977 will be on the pattern of the 1973 Paris Congress with the assistance and sponsorship of Unesco (as

covered up in one of the recommendations mentioned above by Unesco-sponsored Working Party on Solar Energy). The chairman of the International Solar Energy Society (Prof. Löf) is approaching the Government of India in this connection.

The International Solar Energy Congress "The Sun in the Service of Mankind" was held from 2 to 6 July 1973 in which representatives from 60 countries presented some 300 scientific and technical papers. Prof. P. Auger (France) was the President of the Congress. Dr R. L. Datta was a member of the Scientific and Technical Committee of the Congress. Four technical sessions were held simultaneously each day in addition to a number of group meetings and round-table discussions every day on more specialized topics like the effect of sunlight on building materials, photovoltaic cells, small and medium power production, and large-scale power production. Under the broad classifications of Sun and Energy, Sun and Housing, and Sun and Life, there were some 20 technical sessions in five days. Dr R. L. Datta was the chairman of the technical session on "Heliothermic Problems of Constructions." Twelve papers from India were communicated and five were presented. These related to solar distillation, drying, cooling of industrial buildings, dehumidification of room air and photobiological effect. In a series of round-table discussions on power production from pollution-free solar energy, the consensus was that the immediate need of the developing countries was for small and medium capacity power production, and for the developed countries, large-scale production of power from solar energy.

Eighth Session of IHD Coordinating Council of Unesco

Shri S. Banerji, Member-Secretary, IHD National Committee (CSIR), attended the eighth meeting of the Coordinating Council (set up by Unesco to direct its International Hydrological Decade programme launched in

1965) held in Paris from 23 to 30 May 1973. All the 30 members of the council participated. The important international governmental and non-governmental organizations, nine in number, and observers from eight countries took part in the council's deliberations.

Important decisions taken by the council were regarding: (i) setting up of the pattern of its work during the next 18 months; (ii) recommendations to the 18th Unesco General Conference on the set-up of the machinery for implementing the long-term International Hydrological Programme; and (iii) adopting directive guidelines for the National IHP Committees to prepare for the implementation of a meaningful, pragmatic plan under the IHP setting up soon, where this is not yet done, their permanent National Committees for IHP. The Council was particularly concerned about the proliferation of committees, both national and international, dealing with water resources and its uses in regard to hydrological aspects and strongly

urged the IHP National Committees to be effective and wide-based so that such proliferation is avoided. This was in particular reference to the United Nations Environmental Programme which also spreads in the field of water resources. As a result of a strong plea made by the Indo-African delegation, however, the Council agreed to support Regional Committees dealing with hydrological problems affecting a large number of member states mutually agreeing, through their IHP Committees, to cooperate.

However, the immediate task given to the member states was to (i) set up their permanent IHP Committees, (ii) draw up their long-term IHP projects designed to promote progress in the study of rational use of water resources, and (iii) submit the projects to the Council by 1 December 1973 for review and integration with the long-term IHP of Unesco. This will be directed by a 30-member intergovernmental council for IHP to be nominated by the 18th General Conference of Unesco in October 1974.

PROGRESS REPORTS

CFTRI Annual Report : 1971

The annual report of the Central Food Technological Research Institute (CFTRI), Mysore, for 1971 records the progress of R & D activities under the following ten areas: Infestation control and pesticides; Cereals and pulses; Oilseeds and protein foods; Fruits and vegetables; Meat, poultry and fish; Plantation products and flavour; Microbiology; Process development and design; Packaging and containers; and Biochemistry and applied nutrition.

Studies were continued on the stabilization of pyrethrins. A formulation containing pyrethrin and water extract of deoiled neem seed cake showed the same residual toxicity on stored product pests as pyrethrin-piperonyl butoxide formulations (1 : 10). Based on the know-how developed at the institute, a bench-scale Lindane unit was installed at Godhra by an industrial

organization. Conditions for using a mixture of denatured spirit and trichloroethylene in the recovery of Lindane were standardized. A clean-up procedure was developed to eliminate free hydrobromic acid and bromine from methyl bromide, thus eliminating corrosion of cylinder valves and cans due to these contaminants.

Activated montmorillonite, vermiculite and kaolinite were tested as carriers of fumigants for use in bulk storage of foodgrains and in rat burrows; they were found to absorb 625, 373 and 501 mg of ethylene dibromide per gram respectively. A technique has been developed for the detection and semi-quantitative estimation of Aldrin, BHC, Captan, Chlordane, DDT, Endrin and Lindane in the 700-950 µg range. A treated paper strip for detecting phosphine at 0.05-0.3 ppm levels in air has been developed. This will

ensure safety to operators during fumigation with aluminium phosphide.

Studies on the stabilization of rice bran were continued. Three types of equipment, viz. specially designed screw press, rice huller and common *chakki* (plate grinding mill), were tested for stabilizing rice bran by frictional heat produced during operation. The simple *chakki* proved promising; it will be tested on mill scale.

Dehusking of sesame seeds by treatment with lye does not adversely affect the acceptability and quality of oil. The dispersibility of meal protein was, however, reduced due to heat denaturation. A defatted linseed protein concentrate (LPC) with 55% protein has been produced on a bench scale. Supplementation of LPC with methionine and lysine improved the feed utilization and growth of chicks.

Work on *guar* (*Cyamopsis psoralioides*) consisted in the beneficiation of *chuni* and *kurma* grades of commercial meal. By suitable classification and sieving, pure germ fractions containing 50-60% protein were produced. On washing the optimally heat-processed germ fraction with water, a blend protein concentrate containing 70% protein was obtained.

Studies were continued on the manufacture of pectin by the improved process. The formation of foam while mixing pectin extract with alkali in order to precipitate aluminium pectinate has been eliminated. Pressure filtration was more advantageous than centrifugal separation for separating the pectin concentrate from resins. Spray-dried pectin produced on bench-scale had the same quality as the alcohol-precipitated pectin. The powdered pectin produced by the improved technique and formulated to 150 jelly grade was tested and found to compare with the imported pectin.

Studies on the preservation of bananas and mangoes in fresh state to extend their inland as well as overseas trade were continued. Post-harvest treatment with calcium in warm water at 1500-5000 ppm was found to

prevent the development of soft centre, which causes internal breakdown, in *Alphonso* mangoes of 1.00-1.02 specific gravity. A novel method worked out for storing *Robusta* bananas in green condition consists in initially storing green and unripe bananas at 55°F (RH 85%) for 16 days and subsequently for 6 days at 50°F (RH 85%). The fruits stored thus showed normal ripening at 67°F (RH 85%).

The fungal spoilage of Nagpur oranges could be reduced from 16.6 to 2.5% by dipping the fruit in calcium chloride solution, rinsing, drying, treating with wax emulsions containing fungicides, and packing in ventilated wooden boxes.

The effect of additives on the quality of dehydrated mutton mince containing 50% vegetable protein, developed earlier for use by Defence, was studied. Addition of gelatin improved the meat flavour and texture; at low levels, sodium polyphosphate increased the juiciness of the reconstituted product.

Bench scale trials on the freeze drying of shrimp of considerable export potential were carried out and a product with an attractive pink colour and characteristic flavour of fresh material was obtained. Freeze-dried shrimps could be stored for 6-9 months under vacuum in an inert atmosphere.

Edible, non-defatted fish protein concentrate was prepared from oil sardine with different spices and additives or by smoking. The products could be stored in laminated pouches of aluminium for a year. Of the products prepared from trash fish, those found acceptable were: fried fish balls in tomato sauce, processed fish paste and frozen fish blocks.

Bangalore Blue grapes (0.5 tonne) and *Gulabi* grapes (93 kg) were fermented for producing wine. *Gulabi* wine from basket-pressed juice contained a lesser quantity of tannin. Economics of producing brandy from bananas was worked out. The brandy prepared from *Robusta* variety of banana had a mild flavour and that from *Chandra bale* (a red variety of

banana) had the flavour of the parent fruit.

Protease from the culture filtrate of *Botryodiplodia theobromae* was purified; recoveries of the enzyme and its activities were 80% and 90% respectively. Fumigation has been employed to reduce microorganisms in cashew and spices. The trypsin inhibitor from *Aspergillus candidus* was partially purified by precipitation with ammonium sulphate.

The bacterial-ammonia lyase which degrades 2,4-diaminopropionate into pyruvate and ammonia has been purified 30-fold. The foam-forming principle of black gram was found to be a glycoprotein of high molecular weight. Its activity is stabilized in seed by globulins which also possess adhesive properties. The possibility of using this as egg substitute in different food products is being investigated.

Six blends of low-cost protein food (Bal Ahar), based on mixtures of cereal, chickpea flour, peanut flour and soy flour, were prepared. Supplementation of one of the blends (based on 70 : 15 : 15 of wheat, soybean and peanut flours) with methionine increased the protein efficiency ratio (PER) from 2.12 to 2.53. Bal Ahar (based on 70 : 30 of wheat and soybean flour and fortified with calcium salts and vitamins) incorporated in cereal diets at 10% level produced better growth than in control diets.

The know-how relating to the following ten processes/products was released to industry: manufacture of egg albumen flakes; fruit bars; tamarind juice concentrate; distillation of cardamom oil; manufacture of pectin from pectinaceous materials; instant *jamun* flour; oleoresins from spices; manufacture of garlic powder; weaning food; cashew apple, banana and grape brandy, and wine from grapes.

Two patents were filed, one in respect of each of (i) preparation of low bulk density aluminium silicate for use as an insecticide and as a carrier for pesticides; and (ii) improved orange juice extracting machine. Ninety-nine research papers were published.

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

Latex Cement Coating for Reinforcement Protection

The Central Building Research Institute (CBRI), Roorkee has developed a protective latex coating for reinforcement in cellular concrete. The coating can be manufactured from indigenous raw materials and gives satisfactory protection against corrosion.

Mild steel reinforcement in cellular concrete, which is manufactured by autoclaving certain siliceous materials, a calcareous binder and a foaming agent, is highly porous, is prone to corrosion during autoclaving, as also in normal exposure and more so in industrial and marine atmospheres.

Concerns manufacturing reinforced cellular concrete precast units in the country, like the Hindustan Housing Factory and the Cellular Concrete Unit of the Tamil Nadu Housing Board, do not have the know-how for protecting the reinforcement. A firm in Poona is using foreign know-how. The product developed by CBRI is therefore expected to find ready application in the field.

The product has been subjected to rigorous tests. Electrochemical measurements made under corrosive environments and salt exposure test in accordance with the German Standard DIN-4223 show that the coating gives adequate protection to the reinforcement. The coating has also been found to improve the bond between steel and concrete.

Pilot plant trials on the manufacture of protective coating were carried out by mixing 10 kg of portland cement and other required materials in water using a high-speed mixer. The yield was about 12 litres, which is the minimum economic batch. The slurry, thus prepared, would be ready for use after 12 hr. The slurry remained stable for about 24 hr. This quantity was sufficient for coating 400 m of 6 mm diam. bars, i.e. 7.5 m² of steel area.

The main items of plant and machinery required for the manufacture of latex cement coating are a diesel-powered mixer (capacity, 12 litres; speed, 30 rpm) and a tube mill for grinding portland cement to a fineness of 4000 cm²/g. Steel balls of 5 mm size are required for the tube mill. Other equipments include : physical balance, measuring vessels, containers (12-litre capacity), and heating source. Altogether, they cost about Rs 1000 and are available from standard manufacturers.

The raw materials required for each batch of 12 litres are : portland cement (10 kg), natural rubber latex (250 ml), casein (120 g), sodium carbonate (120 g), and ammonia (100 ml). The total cost of raw materials for preparing a 12-litre batch of protective slurry is about Rs 6.20. The process does not entail the import of either the raw materials or equipment.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Microfilters

These are filter cartridges used for a variety of filtrations where clean and compact filtration is required. These filters can be used for removing fine, suspended particles from large volumes of liquids such as potable water, food products and pharmaceuticals. The pore size of the filters is about 10 μ , and the rate of filtration is about 20 litres/min around 30 psi. The filtration assembly is very compact. It consists of a housing in which the filter cartridge is held tight. The cartridge can be cleaned for continued use but should be replaced when pores get heavily clogged up due to prolonged use.

A process for the manufacture of microfilter cartridges has been developed by the National Chemical Laboratory (NCL), Poona. It consists in reacting a thermosetting resin with

high-grade pulp. The resin is well mixed with the pulp and dried. The dried material is powdered in a rotary grinder and sieved. The sieved material is packed in suitable moulds and cured at about 200°C. Laboratory experiments have been conducted with about 600 g of pulp per batch, and five 10-in. long and 3-in. diam. cartridges have been fabricated. These filter cartridges have shown results comparable with those of imported filter cartridges.

Stainless steel jacketed vessel with stirrer, Sigma blade mixer, ovens for drying and curing, rotary knife cutter, sieve and vacuum pump are the major equipment required for the manufacture of the cartridges and all these are available indigenously.

The demand for the microfilter cartridges, not yet produced in the country, is not known. They are, however, quite popular in certain foreign countries and should have extensive potential market in India. The laboratory has assumed 60 000 cartridges per year as the optimum capacity of the plant. The capital for a plant of this size is estimated at Rs 2 lakh (Rs 1.5 lakh on land, buildings, plant and equipment, and about Rs 50 000 as working capital). The cost of production comes to about Rs 3 per cartridge.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Modified Cutch Extract

The original cutch extract is practically of no use to the leather industry as its penetration through the pelt is very slow and as it yields a very dark coloured leather. However, modified cutch extract can be used in place of imported wattle extract for the manufacture of all types of heavy, industrial and chrome retan leathers. In the E. I. tanning industry also, a small percentage of modified cutch extract can be introduced in place of wattle extract. The modified extract could also be used for the preservation of fishing nets, prevention of corrosion in boilers,

in oil drilling operations, in textile industries, etc.

The future demand for modified cutch extract is estimated at about 10 000 tonnes per annum. The market price varies between Rs 1200 and 1600 per tonne.

The Central Leather Research Institute (CLRI), Madras, has developed a process for the production of modified cutch extract which could replace the wattle extract, an imported product, in the manufacture of heavy industrial and chrome retan leathers. The process consists in modifying the highly concentrated liquid cutch extract with different chemicals at high temperature. In case solid or powder extract is required, the treatment is given prior to the drying of the extract. Even the ordinary solid extract as marketed now can be treated, if required, before use.

The modified product both in liquid and powder form has been tested in the laboratory and found to be very satisfactory for leather manufacture. The conditions of application of the product in tannage, using the material alone or blended with other materials, have been standardized.

The work was carried out on 10 kg and 100 kg batch scales. The leather made using modified cutch extract was found to be as good as the one tanned with wattle extract. Samples of the leather produced have been approved by the industry.

The manufacture of the modified cutch extract can be economically undertaken by the manufacturers of cutch extract in both small and large scale units. However, manufacture of solid or spray-dried extract can be economically carried out only in medium or large scale units.

The main raw material needed is the original cutch extract, either in solid or liquid form. This material is available indigenously. Cutch extract in solid form worth Rs 14 to 15 lakh was imported from Nepal and other countries during 1970-71.

The main items of equipment are double jacketed reaction kettle

(complete with lid, stirrer, condenser and other accessories) and low pressure boiler for heating up to 100-110°C. These are available indigenously.

Those who are manufacturing *katha* and cutch extract and possess the boiler will find the manufacture of the modified cutch extract very economical. Depending upon the capacity envisaged the reaction kettle and the boiler would each cost Rs 10 000 to 50 000.

The cost of unmodified cutch extract varies from Rs 1200 to 1600 per tonne. The cost of modification as estimated by the institute is Rs 350-400 per tonne. The modified cutch extract is expected to cost about Rs 700 less per tonne than the imported extract. If wattle extract is substituted by modified cutch extract, the saving in the cost of production of 1 kg of sole leather is estimated at 30-50 paise.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Synthetic Tanning Materials for White Tannage

New synthetic tanning materials using phenol, sulphuric acid, urea, formaldehyde, zinc dust, ammonium hydroxide and oxalic acid have been developed by the Central Leather Research Institute (CLRI), Madras. The products

are meant for white tannage and can be used as self-tanning agent for reptile skins and also for bleaching chrome-tanned leathers.

Leather industry is presently consuming 100-200 tonnes per annum of these products and the estimated future demand is likely to be of the order of 500-600 tonnes per annum.

Based as it is on a simple sulphonation process and indigenously available raw materials, the product is bound to be well received by consumers. A one-tonne per day plant would be an economically viable plant, and requires a fixed capital of Rs 6 lakh. With a working capital of Rs 2 lakh the material can be produced at a cost of Rs 5-6 per kg. As the present market price for this product is about Rs 9000 per tonne, profitability is expected to be high. The equipment needed are glass-lined all-stainless steel or lead-lined jacketed reaction unit assemblies, feed vessels, boiler, chilling plant, pumps, spray drier, weigh-bridge, handling equipments, PVC and stainless steel piping, and containers. These can be easily fabricated in the country. The process is available on very liberal terms.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

CSIR SUPPORT TO RESEARCH

Completed Schemes

Role of Carbohydrate Metabolizing Pathways in Steroid Synthesizing Organs

The synthesis of steroid hormones from the adrenal and gonads has been studied under different experimental conditions involving alterations in the carbohydrate metabolizing pathways. The studies were made by Miss Jayasree Sen Gupta, a CSIR research fellow, working under the guidance of Dr C. Deb at the Department of Physiology, Calcutta University, Calcutta (Oct. 70 to June 72).

Sodium arsenite, which inhibits several enzymes of the glycolytic and tricarboxylic acid cycle pathways, was administered to male and female rats. The cholesterol and ascorbic acid contents of the adrenal, ovary and testis were studied in the rats following daily administration of sodium arsenite for 15 days. In the female rats no significant changes were observed on comparison with the saline-administered control animal cholesterol and ascorbic acid concentrations in the adrenal and ovarian tissues. The vaginal smear study also showed no change in the sodium arsenite-treated animals. In

the male rats however, a slight change was noted; there occurred adrenal hypertrophy together with depletion in the cholesterol and ascorbic acid concentration in the arsenite-treated animals. The testicular ascorbic acid was depleted with concomitant increase in the cholesterol concentration in the arsenite-administered rats as compared with the saline-administered control animals. The study of cholesterol and ascorbic acid concentrations in the steroid synthesizing organs is however an initial step in the assessment of steroid hormone synthesis, and further experiments must be performed prior to reaching any conclusion regarding the role of sodium arsenite and altered glycolytic and TCA cycle activities on adrenal and gonadal steroidogenesis.

Oxythiamine hydrochloride was administered to female mature rats and the steroid synthesis in the ovarian and adrenal tissues was studied. Oxythiamine HCl causes alteration of the pentose phosphate pathway; the NADPH liberated from this pathway, in which glucose-6-phosphate dehydrogenase occupies a key position, has been found to be involved in a number of hydroxylation processes of ovarian and adrenal steroid hormone synthesis. The biochemical estimation of ovarian cholesterol and ascorbic acid contents of the oxythiamine-treated animals showed ovarian atrophy together with significant accumulation of both cholesterol and ascorbic acid. There occurred adrenal hypertrophy following oxythiamine administration along with significant depletion in the cholesterol concentration and an accumulation of ascorbic acid. The histochemical study of Δ^5 -3 β -hydroxy steroid dehydrogenase, the principal enzyme involved in the process of steroidogenesis, revealed suppressed activity of this enzyme in the adrenal and ovarian tissues from oxythiamine-administered rats in comparison with the activity pattern of the enzyme in the glands from control animals. There occurred concomitant suppression of the glucose-6-phosphate dehydrogenase activity and enhanced

succinic dehydrogenase activity in the steroidogenic organs following oxythiamine administration, suggesting inhibition of the pentose phosphate pathway and acceleration in the TCA cycle activity.

The study of uterine weight, which affords a good index of the blood levels of steroid hormones, also suggests an inhibition of steroid hormone synthesis following oxythiamine administration. There occurred a significant fall in uterine weight in the treated animals. From these studies it may be concluded that oxythiamine HCl administration to female mature rats results in depressed synthesis of steroid hormones from the adrenal and ovaries.

The study of steroid synthesis in the adrenal and ovarian tissues following oxythiamine administration was studied in the immature female rats. There occurred a depression in the synthesis of ovarian hormones as indicated by the delay and/or cessation in the onset of maturity in the oxythiamine-treated immature rats. The ascorbic acid and cholesterol concentration of the adrenal and ovaries were estimated biochemically. The distribution and activity pattern of the enzymes Δ^5 -3 β -hydroxy steroid dehydrogenase, the TCA cycle enzyme succinic dehydrogenase and the key enzyme of the pentose phosphate pathway, glucose-6-phosphate dehydrogenase, were studied histochemically in the ovarian and adrenal sections from oxythiamine-treated and control rats. Histological studies of the adrenal and ovaries were also performed.

The synthesis of cholesterol from sodium acetate-1- 14 C was studied in the liver, adrenal and ovarian glands in mature female rats. Following the 15-day treatment of the animals with oxythiamine HCl and thiamine HCl the rats were injected with sodium acetate-1- 14 C and then sacrificed 6 hr later. The uptake and incorporation of the acetate-1- 14 C molecule into the newly formed cholesterol molecule was

studied in the liver, adrenal and ovarian tissues.

The histochemical studies on ovarian and adrenal tissues from oxythiamine-treated and control animals revealed significant decrease in the glucose-6-phosphate dehydrogenase and Δ^5 -3 β hydroxy steroid dehydrogenase and an increase in the succinic dehydrogenase activities in the ovarian interstitial and follicular thecal cells and in the adrenals of the treated animals. The biochemical studies showed significant accumulation of ascorbic acid in the adrenal and ovaries of the treated animals.

In the mature animals the studies of cholesterol- 14 C synthesis from sodium acetate-1- 14 C revealed significant accumulation of 14 C-labelled cholesterol in the liver, ovary and adrenal glands of the oxythiamine-administered rats.

The administration of oxythiamine to rats and the consequent alteration in the pentose phosphate pathway affords an effective approach in the study of the importance of this pathway over TCA cycle in the control of ovarian steroid hormone synthesis, as the former is the dominant pathway. The present study has revealed a positive correlation between the depressed activity of glucose-6-phosphate dehydrogenase and inhibited Δ^5 -3 β -hydroxy steroid dehydrogenase in the adrenals and ovaries of mature and immature female rats following administration of oxythiamine hydrochloride. The same treatment also resulted in an accumulation of ascorbic acid in the adrenals and ovaries of mature and immature animals. The important role of ascorbic acid in the process of steroidogenesis has been reported by earlier investigators. The accumulation of ascorbic acid as a result of oxythiamine treatment may be interpreted as an indication of the inhibition of steroid hormone synthesis. The accumulation of labelled cholesterol in the liver and steroid synthesizing organs may be interpreted as an indication of the impaired utilization of cholesterol in the synthesis of steroid hormones.

On the basis of the above findings it may be suggested that there occurs a depression in steroid biogenesis in the mature and immature rats following alteration of the pentose phosphate pathway as a result of oxythiamine administration.

PATENTS ACCEPTED

Indian Pat. 129469

Thin layer chromatography plaster from mineral gypsum

S. P. Krishnaswami & S. K. Mehta
RRL, Jammu

Commonly used adsorbents in thin layer chromatographic work are silicic acid (silica gel), alumina, and kieselguhr. Many of the adsorbents do not possess the necessary binding property, and a special grade plaster of Paris or calcium sulphate dihydrate is used as a binder. The main function of the binder is to make the adsorbent more cohesive and hold it to the plate used in analytical work. Plaster of Paris is used to the extent of 20% with the adsorbents.

Gypsum or calcium sulphate dihydrate, the base material for plaster of Paris, is sparingly soluble in water and practically insoluble in most of the organic solvents but soluble in mineral acids. Calcium sulphate does not cause or stimulate organic reactions. Being stable, non-toxic, tasteless, odourless, non-abrasive and chemically inert (to organic compounds), gypsum is an ideal binder in chromatographic work. Calcium sulphate dihydrate or plaster of Paris used in chromatographic work is presently obtained from chemically prepared (precipitated) variety. Naturally occurring gypsum is considered not suitable as it is associated with many impurities such as clay, carbonates of alkali and alkaline earth metals, and iron.

Massive gypsum imparts binding characteristic to a greater degree than the chemically prepared material. The absorptive power of gypsum is considerably influenced by particle size distribution in the matrix and this can be easily controlled in the product prepared from the mineral than in the chemically prepared one. Despite

these advantages the mineral had not found use in TLC work because of the associated impurities and the difficulty of winning the gypsum in a pure state from the intercalating plastic clays and other impurities.

The process for the preparation of TLC plaster from mineral gypsum, covered by the patent, is simple and the equipment required in the process are indigenously available. The mineral lump is broken and crushed to suitable grain size. Beneficiation is carried out to eliminate or reduce the content of the associated inorganic impurities such as clay, and other inert materials. Further treatments are given to reduce the content of iron, carbonates and other organic matter, if any. By adopting this technique a gypsum mineral containing 3.2% impurity was purified to the extent of 99.5%.

Calcium sulphate dihydrate or plaster of Paris is used as a binder along with other adsorbents. The column prepared from the plaster of Paris alone may be used as it not only imparts the necessary bonding property to the plates used in the work but also induces a certain amount of adsorption capacity. The high cost, Rs 40.00 or more per kg, of calcium sulphate dihydrate was a deterrent factor for its extensive use. By the process developed, material of requisite purity may be prepared at a comparatively low cost.

Indian Pat. 129055

Process for making membrane filters (designated as membrane filter B) for microfiltration of bacteria which exceed in dimension the filter pore size

M. V. Nanoti & K. R. Bulusu
CPHERI, Nagpur

Membrane filter technique is a direct method of counting the colonies and is used as a standard procedure to test the presence of coliform group of organisms in water. For bacteriological evaluation, water is filtered under vacuum through specially made membranes in a metal or glass assembly. After filtration, the filter paper disc with the organisms retained over it is

removed and placed on a sterile absorbent pad previously saturated with a suitable medium in a petridish. The petridish with the pad and the filter is incubated at 37°C under humid conditions for 18-20 hr in an inverted position. Typical dark brown colonies with green metallic sheen resulting from the growth of coliform bacteria are then counted. This technique has proved valuable particularly in filtering relatively large volumes of the samples (provided they are not very turbid) and gives results within 20 hr as against 72-96 hr required for multiple tube dilution technique used in India in the routine analysis of water.

Membrane filter (MF) technique has not received wide attention in the country as the membrane filter has to be imported and each filter disc of 47 mm diam. costs about Rs 3.

The process under patent relates to the indigenous development of membrane filters, designated by the patentees as membrane filter-B (MF-B). These membranes are made from cellulose ester in the form of uniform white discs of 47 mm diam. without grid marking. Filters of other sizes ranging from 30 to 142 mm diam. can also be made. These are $120 \pm 10 \mu$ in thickness and have pores of $0.40 \pm 0.05 \mu$. The filtration rate of water is $5.0 \pm 1.0 \text{ ml cm}^{-2} \text{ min}^{-1}$ under 380 mm Hg vacuum. The MF-B turns transparent when cedarwood oil is applied to it, thus permitting examination of particles on the filter surface by the transmitted light. It can be used for filtration of aqueous solutions in the pH range 2-11.

The filters have been tested in different research establishments and found comparable to imported membrane in performance.

The culture medium required for the bacteriological examination of water with the membrane filter technique has also been developed by the institute. The cost of the medium is Rs 7 as compared to Rs 83 for the multiple tube dilution test for carrying out 100 tests.

The annual demand for MF-B (47 mm diam.) is estimated at one

million. The main raw materials required are cotton, sulphuric acid, nitric acid, commercial caustic soda, bleaching powder, methyl acetate, ethyl alcohol, *n*-butanol and glycerine. All the raw materials are available indigenously.

The various items of plant and machinery required are : cellulose preparation unit (comprising digester, hot air oven and bleaching unit); nitration unit (comprising glass-lined reaction vessel or good quality steel vessel with stirring device, stainless steel vessel and oven); jelly preparation unit (comprising stainless steel vessel, vacuum filtration unit and freeze); and membrane preparation unit (comprising airtight airconditioned room, jelly spreading planes and membrane drying plates).

For producing one million pieces annually the total capital outlay has been estimated at Rs 2 lakh, and the running cost at about Rs 2.5 lakh. The cost of production of MF-B of 47 mm diam. is 22 paise per piece.

PATENTS FILED

373/Cal/73 : Simultaneous fiberization and blending process for part replacement of chrysotile asbestos by amphibole asbestos fibre in asbestos-cement products, A. K. Chatterjee, K. D. Dhariyal & R. S. Rawat—CBRI, Roorkee.

464/Cal/73 : Improvements in or relating to a process for the separation of iron, cobalt and nickel from their solution by solvent extraction, P. K. Rao, P. V. R. B. Sarma, B. C. Mohanty & P. K. Jena—RRL, Bhubaneswar.

516/Cal/73 : Improvements in or relating to rust and scale removing jelly, K. S. Rajagopalan & C. Rajagopal—CECRI, Karaikudi.

567/Cal/73 : Pyrogenic ignition system for after-burners/duct burners of jet engines, S. Subrahmanian, G. Murthy & P. A. Paranjpe—NAL, Bangalore.

601/Cal/73 : Multispeed hub for vehicles such as bicycles, S. K. Rao, S. C. Sarmah, U. Choudhury & M. S. Iyengar—RRL, Jorhat.

641/Cal/73 : A new method of making thermosetting phenolic moulding powder, D. Mahanta, A. Rahman, B. P. Chaliha & M. S. Iyengar—RRL, Jorhat.

642/Cal/73 : A novel device for locking deflection coil to TV picture tubes, J. P. Raina, I. Singh & T. R. Vasudeva—CEERI, Pilani.

643/Cal/73 : Improvements in or relating to continuous ultrasonic emulsifier, R. S. Rohella & K. M. Swamy—RRL, Bhubaneswar.

644/Cal/73 : Three-speed hub for vehicles such as bicycles, S. K. Rao, S. C. Sarmah, U. Choudhury & M. S. Iyengar—RRL, Jorhat.

669/Cal/73 : An improved process of dyeing wool, hair bristles and other keratinous fibres into fast non-bleeding jet-black shade, S. K. Barat & M. S. Kalbagh—CLRI, Madras.

670/Cal/73 : A process and equipment for producing sponge iron, V. A. Altekar, K. N. Gupta, B. K. Paul & V. K. Soni—NML, Jamshedpur.

721/Cal/73 : A letter bomb detector, T. N. Ghose, P. N. Taneja, G. K. Sharma & R. P. Pande—NPL, New Delhi.

791/Cal/73 : AC/DC electrical relay tester, R. Tarafder, B. Ghara & G. Lakshminarayanan—CMRS, Dhanbad.

792/Cal/73 : Borehole seal, B. D. Banerjee—CMRS, Dhanbad.

793/Cal/73 : A toroidal winding machine, F. Singh & J. Singh—CEERI, Pilani.

Environmental Pollution

The proceedings of the symposium on Environmental Pollution, organized jointly by the Central Public Health Engineering Research Institute (CPHERI) and the Indian Association for Water Pollution Control (IAWPC) at CIPHERI, Nagpur from 17 to 19 January 1973, have just been published by the institute. The volume (demy 4to, 372 pages) contains 44 papers grouped under eight chapters : (1) Water pollution; (2) Industrial waste treatment; (3) Sewage treatment; (4) Water quality; (5) Water treatment; (6) Solid wastes; (7) Air pollution; and (8) Other

aspects. Floor discussions on some of the papers presented are also included. An account of the proceedings of the symposium has been published in *CSIR News*, 23 (1973), 54.

Enquiries regarding the publication may be addressed to : The Director, Central Public Health Engineering Research Institute, Nehru Marg, Nagpur 440020.

Twenty-five Years of Geophysical Research in India

This is a publication brought out jointly by the Indian National Science Academy, the Geophysics Research Board of CSIR, and the National Geophysical Research Institute (NGRI), Hyderabad. The publication (royal 8vo, 178 pages) contains 14 review articles: (1) Role of geophysics in exploration for oil; (2) Geodetic and other important activities of the Survey of India; (3) Physical properties of rocks; (4) Remote sensing; (5) Development of geochemistry; (6) Observational and research activities; (7) Progress in geochronology; (8) Progress in seismology; (9) Integrated regional surveys; (10) Atmospheric sciences; (11) Geophysical education; (12) Structural and tectonic studies; (13) Geophysics in 1997; and (14) Modern developments in seismology and future perspective.

Enquiries regarding the publication may be addressed to : The Director, National Geophysical Research Institute, Hyderabad 7.

CPHERI, Nagpur

The Central Public Health Engineering Research Institute (CPHERI), Nagpur has now come under the purview of the Coordination Council for Engineering Group of CSIR laboratories and cooperative research associations. Earlier, CIPHERI was in the Biological Sciences Group.

Shri T. V. Ananthan

Shri T.V. Ananthan, Director, Bombay Textile Research Association, Bombay, has been elected a Fellow of the Textile Institute (F.T.I.), Manchester (UK).



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NO. 16

Burmese Delegation Visits CFRI

A Burmese delegation consisting of U Kyaw Aung, General Manager of Coal Mines, Kalewa and U Ba Kyi, General Manager, Steel Rolling Mill, Insein, visited the Central Fuel Research Institute (CFRI), Dhanbad on 26 July 1973 to make a study of the technical expertise available in India for their country's development. Keenly interested in establishing projects for steelmaking, fuel-based industries, etc. based on Burma's natural resources, the delegation discussed in detail the work of the institute with the Director and senior scientists. Later, they visited some pilot plants. The visitors evinced considerable interest in CFRI's processes for utilizing non-coking coals for metallurgical purposes. It was felt that Burma, which possesses some reserves of tertiary coals, could take advantage of the researches of CFRI. The project study undertaken by CFRI on the utilization of Kutch lignite was a major topic of discussion. The Director offered to undertake studies on the possibilities of production of formed coke from Burmese coals if a project is sponsored.

Quality Assessment of Raw Coal Feed to Dugda Washeries

The Technical Committee on Coal Washeries (1970-71), constituted by the Government of India, stated in its report that one of the reasons for the poor functioning of the existing washeries was the deterioration in the quality of the feed coal. In this context, the

Central Coal Washeries Organization of the Hindustan Steel Ltd requested the Central Fuel Research Institute (CFRI), Dhanbad to investigate whether coal suppliers were supplying the correct grade of coal contracted for the Dugda Washeries I and II.

The studies carried out by CFRI have shown that the average ash content of HH grade coal, forming the bulk supply, was much above the expected value which ranged between 20 and 24%. The range of ash variation for the samples tested was 23-33%. Except in a few individual cases, the same trend was observed for other grades also. Higher ash percentage in raw coal has also been found to adversely affect the coking property.

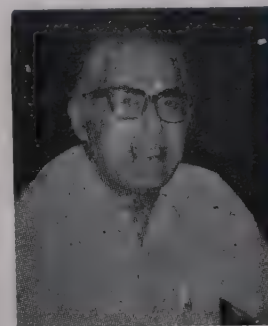
Screen analysis data of coals from a single source supplying two grades of coal to either of the washeries revealed that there was consistency between the screened fractions within a washery. Between washeries, there was no variation in the size range 25-13 ($1\frac{1}{2}$ in.). In other sizes, the difference was well defined.

Shri S. Bagchi

Shri S. Bagchi, Deputy Director-in-charge of the Coal Survey Stations of the Central Fuel Research Institute, Dhanbad has been appointed Director, Central Mining Research Station, Dhanbad. He took over on 30 July 1973.

Shri Bagchi (born 1923) had a distinguished academic career. After graduating in science from the Presidency College, Calcutta University (1942), he joined the Indian School of Mines, Dhanbad, and secured a first class in both certificate (1947) and AISM Dip-

loma (1948) examinations. In 1948, Shri Bagchi successfully qualified as a



Second Class and a First Class Mine Manager. He also obtained the Mine Surveyor's certificate during the same year from the Department of Mines of the Government of

India. He was awarded the Coloinbo Plan scholarship for postgraduate studies in mining engineering at the Sheffield University, UK and obtained the Postgraduate Certificate from the Mining Department in 1953.

While abroad, he had advanced practical training in large-scale mine mechanization problems and in modern mining operations in the mines in UK and in the Continent and had specialized training in premier mining research establishments in UK, Holland and Germany.

Shri Bagchi's first professional appointment was with Bird & Co. (P) Ltd, and F. W. Heilgers and Co. (P) Ltd, as mining engineer where he acquired industrial experience for about eight years (1949-1956).

Shri Bagchi joined the Council of Scientific & Industrial Research in early 1958 as Assistant Director at the Central Mining Research Station, where he was directly concerned with its planning, construction and developmental work and became its Deputy Director in 1960. For a short period he was transferred in 1961 to the Indian Institute of Petroleum, Dehra Dun, as Deputy Director-in-charge.

CFTRI LIBRARY
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In November 1963 he was transferred to the Central Fuel Research Institute as Deputy Director-in-charge of the Coal Survey Stations where he continued until he took over as Director, CMRS. When he was at CFRI, he was on deputation for two years with the Mining and Allied Machinery Corporation, Durgapur, as the Chief Project and Development Engineer.

In 1965 Shri Bagchi visited Poland and West Germany as a member of the scientific delegation under the Scientific Exchange Research Programme.

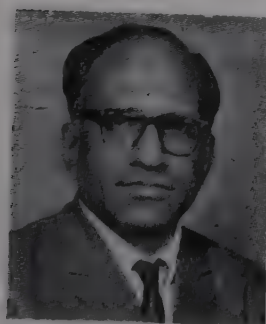
Shri Bagchi is a council member of the Mining, Metallurgical and Geological Institute of India and a Chartered Engineer; he is also member of the Institute of Mining Engineers (UK), Institute of Fuel (UK), and Mining, Geological and Metallurgical Society of India. He is also on the Governing Body of the Productivity Council (Dhanbad branch).

Shri Bagchi has to his credit more than 100 research and investigation papers.

Prof. M. Santappa

Prof. M. Santappa, Senior Professor and Head, Department of Physical Chemistry, University of Madras, Madras, has been appointed and has assumed charge as Director, Central Leather Research Institute, Madras on 1 August 1973.

A distinguished graduate from the Universities of Madras, Manchester and London, Prof. Santappa has been



Prof. M. Santappa is a distinguished graduate from the Universities of Madras, Manchester and London. He has been Professor and Head of the Department of Physical Chemistry, University of Madras, for the past 21 years. Prof. Santappa's achievements relate to synthesis of graft copolymers by a simple chain transfer process and studies on the properties of macromolecules by light scattering and osmotic techniques. Syntheses and kinetic studies of condensation polymers involv-

ing tetra- and tri-alkyl phenols and formaldehyde have yielded valuable information.

Prof. Santappa has built up a flourishing school of research and has trained a large number of research scholars in polymer chemistry, oxidation kinetics and complexometry. He has to his credit 135 research papers in internationally reputed journals.

Prof. Santappa (49 years) is a Fellow of the Indian National Science Academy, the Royal Institute of Chemistry, and of the Indian Academy of Sciences, Bangalore. He is the recipient of the 1967 Shanti Swarup

Bhatnagar Memorial Award in chemical sciences for outstanding contributions in the field of polymer chemistry.

Prof. Santappa is well aware of the problems of chemical and allied industries and has considerable expertise in the planning and organization of these industries. Being associated with the various high-power committees of the Ministry of Industrial Development Government of India, he has been intimately connected with the research and development activities of CLRI and has guided its research programmes and policies by serving as chairman of its Collagen Committee.

PROGRESS REPORTS

NAL Annual Report : 1971-72

The National Aeronautical Laboratory (NAL), Bangalore, has brought out its annual report for 1971-72. The 88-page report (demy 4to) records the progress of R & D work under the following disciplines: Aerodynamics; Propulsion; Structural sciences; Materials science; Electronics; Instrumentation; and Mathematical sciences. Against total financial inputs of Rs 11.50 million (Rs 5.06 million capital and Rs 6.45 million recurring) the income of the laboratory during the same period amounted to about Rs 1.80 million.

The 4-ft trisonic wind tunnel, the laboratory's major facility in aerodynamics, was fully utilized, and about one thousand runs were carried out at the request of organizations and test results supplied to them. A number of test runs were devoted to the optimization of external stores location on a combat aircraft configuration. A balance calibration rig was designed and fabricated. The rig can be used to calibrate balances up to 5000 lb normal force and 20 000 in.-lb pitching moment. Development of 1-ft tunnel equipment was continued. Work is under way to replace the wooden nozzle blocks, which exhibited dimensional instability, with aluminium blocks. The $M=2.5$ nozzle

block and the wooden pattern for aluminium casting for $M=2.2$ blocks were completed.

In the Propulsion Division, considerable progress was made in the fabrication and instrumentation of Combustion and Gasdynamics Laboratory.

Development work on a pressure-insensitive type fluidic oscillator as a temperature sensor was continued. The stainless steel oscillator, tested up to 600°C, was found to give satisfactory performance with respect to accuracy in temperature measurement, reproducibility and sensitivity characteristics.

The foundation for the turbine research rig was constructed. A high-speed hydraulic dynamometer was installed along with the pumps, sumps and ducting for its cooling system.

At the instance of the Heavy Electricals Ltd, Bhopal, cascade testing of steam turbine blade profiles was undertaken, and a report based on cascade tests for different specified inlet angles and Mach numbers was submitted.

A 1/10th scale high-speed flutter model wing was designed to suit the characteristics of 4-ft trisonic wind tunnel. Replica form of construction was adopted and the model was fabricated from thin aluminium sheet. Necessary modifications on the tunnel support system were also incorporated for mounting the present model.

The manual system for multipoint excitation developed in the laboratory was commissioned and subjected to extensive tests. Employing this system, dynamic influence coefficients on plate type structure with different aspect ratios were generated to establish the single-point excitation technique on continuous structures. Analytical expressions were developed for deflections of beam type sandwich structures. Dynamic characteristics of torsional dampers were determined at the request of an industry.

Crack propagation tests on specimens made from commercial aluminium alloys such as L73, DTD687A, VLW3116.5 and DTD610B were carried out to determine the effect of prior elevated temperature exposures on fatigue crack propagation, and a detailed report was prepared for the Hindustan Aeronautics Ltd, Bangalore.

The random noise fatigue testing machine was calibrated for static loads and significant modifications were made to eliminate unwanted resonances. Special test rigs for testing component specimens were designed and are being fabricated.

In the field of materials science, the laboratory's activities were mainly in the following areas: fabrication and processing of materials, creep-fatigue interactions, composites, high temperature materials, material testing, and high pressure studies. The production of low nitrogen content chromium, (500 g per 24 hr) was scaled up to a semi-pilot level. The feasibility of the following five projects was studied: (i) manufacture of FRP helicopter blades, (ii) fabrication of honeycomb structure for HAL, (iii) fabrication of FRP drop tanks for IAF, (iv) development of multimissile launchers for ADE, and (v) development of doubly curved antenna reflectors for TIFR and LRDE.

A direct current polarographic method for the determination of fluoride and silicofluoride was developed. A 1000-tonne press was fabricated and commissioned for conducting high pressure studies. Two smaller presses of

300 and 800 tonnes capacity were also fabricated. A tungsten carbide camera and diamond anvil camera were constructed for X-ray diffraction studies up to 60 kbar and 30 kbar respectively.

In the Electronics Division, capability buildup in digital and analog techniques, and high power circuits was continued. A 3-digit digital-to-analog converter was designed for use in an X-Y plotter. This enables plotting of output data in paper tape form from the SIRIUS computer. A solid-state speed controller for use with dc motor was designed. The controller possesses an accuracy better than $\pm 1\%$ over the full range of power supply voltage, loading and a temperature range of 20–50°C. Important digital devices and systems built during the period include a 500-channel data system for SERC (Regional), Madras and a radio reporting rain gauge system for the India Meteorological Department.

Wrap-around wire type strain gauges were developed and a total of 2000 strain gauges were produced and found satisfactory. Under a project sponsored by the School of Aviation Medicine, a pilot oxygen mask flow

and pressure measuring instrumentation scheme was developed. A mass flow indicating meter using pressure transducers, developed by NAL, for use with Propulsion Division's test cells was designed, developed and commissioned.

Research in human pilot dynamics was started during the year. A fixed base two degree of freedom research simulator was designed with complementary data acquisition system.

An important achievement in the field of mathematical sciences was the development of a translator to translate SIRIUS autocode instructions to FORTRAN statements.

The know-how relating to the following seven processes/products was ready for release to industry: electrical resistance wire strain gauges; shaft position digitizer; code-to-decimal translator; dc amplifier; edge illuminated display; logic circuit blocks; and vibration meter with pickup.

A patent relating to visco pump-bearing-seal, a device for supporting axial-radial loads and dynamic sealing, was filed. Forty-three research papers were published during the year.

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

Improved Process for Manufacture of Wettable Crust Leathers using Zirconium Salts

A process has been developed by the Central Leather Research Institute (CLRI), Madras, for the manufacture of wettable crust leathers using zirconium salts either alone or in conjunction with chrome salts. The process consists of pretreatment of pelt with naphthalene sulphonic acid and formaldehyde, followed by zirconium tannage or by a chrome-zirconium combination tannage. The leathers thus produced are comparable in all respects with the conventional semi-chrome leathers used for garment and suede manufacture, with the additional advantages of light colour, amenability to fast and deep dyeings, and improved fastness to light.

Normally, semi-chrome leathers are produced from the well-known E. I. tanned leathers and finished to various types of leather by the countries which import E. I. leathers. The present process affords a possibility of exporting the Cr-Zr or Zr leathers in the place of E. I. leathers in a dry condition. These are easily wettable without the use of wetting agents, and could be easily processed to different types of finished leathers like garments and suedes. The cost of manufacture of leathers produced by this process has been found to be 5 paise less per sq ft as compared to the leathers produced by the conventional semi-chrome process starting from E. I. leathers. There is no import constituent in the raw materials as naphthalene sulphonic acid, formaldehyde, chrome

extract and zirconium sulphate are all locally available. Pilot plant tests have confirmed the technical and economic feasibility of the process developed.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Clofibrate

Clofibrate—ethyl 2-(*p*-chlorophenoxy)-2-methylpropionate—is a valuable drug used in the treatment of atherosclerosis and coronary artery diseases. The drug is not manufactured in India and is imported under the trade name Atromid S (ICI). The requirements of the drug are estimated at about 3 tonnes per year.

With a view to making the country independent of the import of this important drug, investigations were undertaken at the National Chemical Laboratory (NCL), Poona, and a process for the manufacture of Clofibrate has been developed. The process consists of two steps, viz. (i) preparation of 2-(*p*-chlorophenoxy)-2-methylpropionic acid by the condensation of *p*-chlorophenol, acetone and chloroform in the presence of sodium hydroxide; (ii) esterification of the resultant acid with ethanol and concentrated sulphuric acid to obtain the finished product—Clofibrate. The process has been standardized on one kg per batch scale. The product has been tested by analysis and found comparable to the imported product.

p-Chlorophenol, chloroform, acetone, sodium hydroxide, benzene, concentrated hydrochloric acid, absolute alcohol, concentrated sulphuric acid, and sodium bicarbonate are the main raw materials required for the manufacture of Clofibrate. Except *p*-chlorophenol, all raw materials are available indigenously.

Stainless steel reactor (steam-jacketed with reflux condenser), separator, vacuum pump, stirring motors, glass reactors, heating mantles, distillation column with fractionating head condenser and receiver, and drier are the

major items of plant and equipment. All these are either available indigenously, or can be fabricated in the country.

The National Chemical Laboratory has assumed 3 tonnes per annum as the optimum capacity for the manufacture of Clofibrate. The total capital outlay for a plant of this size is estimated at Rs 3.00 lakh (Rs 1.90 lakh on building, plant and equipment, and Rs 1.10 lakh as working capital). The cost of production of the material according to the process developed at NCL comes to Rs 83 per kg.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Lanolin from Crude Wool Grease

Refined wool grease, which is generally known as lanolin, is used for various purposes—as metal lubricant, in cosmetics, in rust prevention, as lube oil additive, in pharmaceuticals, adhesive tapes, soaps and paints.

Several processes are known for the separation of lanolin from wool grease. All these processes however suffer from one or more of the following disadvantages:

1. Unit operations involved are quite large in number.
2. Costly adsorbents are employed.
3. The number of chemicals required is too many.
4. High pressure and/or high temperature equipments are required.
5. Separate deodorization and/or decolorization steps are involved.
6. A separate dehydration step is involved for the preparation of anhydrous lanolin.
7. Pretreatment of feed is sometimes necessary.
8. A centrifuge is required for final separation.

A simple and economical process for the preparation of lanolin from crude wool grease has been developed by the Indian Institute of Petroleum, Dehra Dun. The process consists of contacting crude wool grease with

adsorbent in a definite ratio at a certain temperature and aging the mixture thus obtained for several hours at a temperature above its melting point before subjecting it to extraction with an aromatic solvent at room temperature, followed by filtration and removal of solvent by distillation. Distillation is carried out in such a way that bottom temperature does not exceed 150°C. Final traces of solvent are removed by stripping.

The process has several advantages:

1. Use is made of a better, single adsorbent to get superfine or better grade of lanolin.
2. Extraction with solvent at room temperature is adequate.
3. Only two chemicals (adsorbent and solvent) are required in the entire process.
4. Decolorization and deodorization are accomplished in the same step. Colour is much superior than specified for superfine grade lanolin.
5. Acid value is reduced to a greater extent in this process than in any other process. No neutralization with alkalis is required.
6. Any crude wool grease, irrespective of the method of scouring, can be used.
7. It is not necessary to desorb lanolin from the grease-adsorbent complex before solvent extraction.

8. Solvent recovery is good.

The process has been studied only on a laboratory scale. A sample of lanolin prepared at the laboratory was sent to a firm for tests, and the firm has approved the sample. The product conforms to the specifications laid down in BP, USP, etc.

All the raw materials needed in process are available indigenously.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Acrylic Copolymer Emulsion

By copolymerizing a mixture of ester monomers in aqueous media using persulphates as catalyst with suitable emul-

sifiers, acrylic base coat and top coat for leather finishing have been prepared by the Central Leather Research Institute (CLRI), Madras. The base coat resin has good adhesive properties and flexibility and helps to bind the colouring materials to the leather. The top coat resin has good flexibility and adhesive characteristics, gives a medium gloss to the finished surface and possesses non-tackiness with reasonable fastness properties.

Similarly, the institute has prepared another type of copolymer solution using organic peroxides as catalyst and solvents like xylene or methyl isobutyl ketone (MIBK). By virtue of its good adhesive strength, gloss and water repellent properties the acrylic copolymer solution finds application as a top coat for finishing leathers. This lacquer is found to be cheaper than the conventionally used N. C. lacquers. Though produced only on a laboratory scale, the materials have attracted the attention of consumers, thereby ensuring a good demand in the future. The method of preparation is very simple and easily controllable.

The estimated future demand for the base coat is 300 tonnes per annum, and that of top coat is 100 tonnes per annum.

The total outlay in respect of a unit for the production of acrylic copolymer emulsion is Rs 1.15 lakh, comprising Rs 50 000 as fixed capital on building, Rs 35 000 as fixed capital on plant, and Rs 30 000 as working capital. The cost of production is estimated at Rs 8-10 per kg. The present market price is Rs 12-14 per kg.

Reaction kettles with necessary auxiliary equipments and steam generator are the main items of equipment.

The raw materials required are : methyl acrylate, ethyl acrylate, methyl methacrylate and butyl acrylate (acrylic ester monomers); solvents like MIBK and xylene; catalysts (persulphates, organic peroxides, etc.); emulsifiers (non-ionic and anionic). Except monomers all the other ingredients are available indigenously. The monomers require to be imported for, sometime

and will be produced indigenously in the near future.

The quantities of raw materials required for producing 1 kg of finished product have been worked out. The suggested plant capacity is 100 kg per day.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Pickerol

The need for a good substitute for imported sperm oil used for steeping raw hide pickers in order to preserve them has long been felt. The entire requirement of this oil, of about 30 tonnes per annum, is being met by import at a cost of about Rs 5000 per tonne. The demand for this oil is steadily increasing and the annual demand is likely to be about 40 tonnes, valued at Rs 2 lakh in foreign exchange.

Pickerol is a good substitute for sperm oil, and is made from indigenously available oil by a simple and inexpensive process developed by the Central Leather Research Institute, Madras. The product produced in a pilot plant of 80 kg per batch of 8 hr has withstood the test for quality, and has been well received by consumers.

Small-scale manufacturers of chemicals can diversify their production by adding to their list Pickerol which needs only a small capital investment of about Rs 17 000 for fabricating and installing a steam-heated stainless steel jacketed vessel with a stirring arrangement.

An investment on Pickerol is quite attractive, for the return on capital is likely to be very high.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

CSIR SUPPORT TO RESEARCH

Completed Schemes

Flow in Laminar Compressible Boundary Layers

Under a CSIR fellowship, the following aspects of flow in laminar compressible boundary layers have been studied by Miss C. S. Vimala at the Department of Applied Mathematics, Indian Institute of Science, Bangalore. The research scholar carried out the studies under the guidance of Dr G. Nath.

The two-point boundary value problem of laminar compressible boundary layers created by the passage of a plane shock wave over an infinite flat plate or by the motion of the plate has been reduced to an initial value problem through the use of the theory of transformation groups. The advantages of the method over the methods employed usually are that it gives good results without initial guesses and iterative processes, and is simple and direct, both in concept and application.

The unsteady flow in a laminar compressible boundary layer in the vicinity

of a two-dimensional stagnation point due to an incident stream with an unsteady velocity has been studied by means of a transformation which maps an infinite interval $[0, \infty]$ to a finite interval $[0, 1]$. The governing partial differential equations involving both the time variable and independent similarity variable have been solved by converting them into a matrix equation with the help of finite difference schemes.

The technique of quasilinearization has been applied to study the effects of suction and injection on : (i) swirling flow in a laminar compressible three-dimensional axisymmetric boundary layer, and (ii) hypersonic flow in a laminar compressible boundary layer on a yawed infinite wing. It has been found that both the skin friction and heat transfer parameters increase with suction and decrease with injection. As the method fails for the case of large injection, this case has been treated by the method of matched asymptotic expansions.

The effect of slip on the swirling low speed flow of a slightly rarefied gas in axisymmetric three-dimensional compressible boundary layer has been investigated by making use of perturbation technique. It has been possible to solve the problem by the method of quasilinearization also. Even though the phenomenon of slip is unable to influence the nature of the flow, it is capable of reducing the skin friction and heat transfer, thereby increasing the velocity and enthalpy near the wall.

The method of parametric differentiation, a slight generalization of the concept of infinitesimal perturbation around a known solution, has been used to investigate the effects of heat and mass transfer on the properties of general three-dimensional stagnation point flows. The results obtained agree fairly well with those obtained by other methods.

Infrared and Raman Spectroscopy of Selenates and Amino Acids

The Raman and infrared spectra of four inorganic selenates and twelve amino acids have been investigated by Shri N. V. Sankaranarayanan, a CSIR research fellow, working at the Department of Physics, Indian Institute of Science, Bangalore, during the period October 1970–December 1972. The studies were carried out under the direction of Prof. R. S. Krishnan of the Department. The interesting physical properties of some of these crystals have been attributed to the dynamics of molecular groups in the crystals. Many of the frequencies in the spectra of amino acids have been assigned, and some new features on the spectra have been pointed out.

The selenates investigated are $(\text{NH}_4)_2\text{SeO}_4$, $\text{LiNH}_4\text{SeO}_4$, $\text{NaNH}_4\text{SeO}_4 \cdot 2\text{H}_2\text{O}$, and K_2SeO_4 . The last two are known to undergo ferroelectric phase transitions at low temperatures. Ammonium selenate, unlike its sulphate analogue, is not known to show any phase transitions. Lithium ammonium selenate has not been studied so far for its physical properties, either at room temperature or at low temperature.

The Raman and infrared spectra of the above crystals and the deuterated analogues of the hydrogen-containing compounds were investigated both at room temperature and at low temperature. In ammonium selenate, it is found that the internal vibrations of the NH_4^+ and SeO_4^{2-} ions are split, indicating a low symmetry of these ions in the crystal. It is also inferred that the ammonium ion executes torsional oscillations in the crystal. In $\text{LiNH}_4\text{SeO}_4$ the most important feature is the presence of bands in the $450\text{--}500\text{ cm}^{-1}$ region which have been identified as due to Li-O stretching vibrations. Sodium ammonium selenate shows remarkable changes in the spectra at low temperatures and these have been interpreted as due to the ammonium ions which execute torsional oscillations both in the para and ferroelectric phases. It is also concluded that the water molecules undergo changes in their orientation at the ferroelectric transition. The Raman spectrum of K_2SeO_4 was recorded for the first time.

The Raman and infrared spectra of the following amino acids were studied: arginine, cystine, glutamic acid, glutamic acid HCl, glutamine, monosodium glutamate, hydroxyproline, isoleucine, threonine, tyrosine, serine and valine. The high frequency spectra have been interpreted as due to the hydrogen bonded N-H and O-H stretching vibrations. A band of medium intensity at about 2100 cm^{-1} in the spectra of amino acids containing NH_3^+ group has been identified as due to a combination band of NH_3^+ degenerate bending and NH_3^+ torsion. The lattice spectra of the amino acids have been recorded for the first time.

PATENTS ACCEPTED

Indian Pat. 133700

Improvements in or relating to the production of high hardness steels
Rajendra Kumar & S. P. Mukherjee
NML, Jamshedpur

The process covered by the patent deals with the technology of production of high hardness steels containing tita-

nium, silicon, aluminium and manganese. Special features of the process are as follows:

- (1) Indigenously available alloying elements are used in place of the conventionally used alloying elements (imported hitherto), such as tungsten, molybdenum and vanadium, to impart corresponding hardness in steels.
- (2) Based as it is on the principle of precipitation hardening the process enables any section to be fully hardened.

The new steel has the following properties: high hardness (approx. 650 VPN) on heat treatment; no distortion on heat treatment; thermal and dimensional stability on prolonged exposure to elevated temperature, i.e. the steel retains its high hardness up to 500°C ; and wear resistance.

The steels are expected to find applications in the manufacture of a variety of implements, cutting tools, extrusion dies, wear and abrasion resistant parts, and in other engineering components requiring abrasion resistance.

Indian Pat. 127956

Improvements in or relating to the production of lead powder by direct reduction of lead compounds and/or spent lead acid battery plates

H. V. K. Udupa, P. V. V. Rao & R. Vijayavalli
CECRI, Karaikudi

The invention covered by the patent relates to a process for the production of lead powder by direct electrochemical reduction of lead compounds. By this process, byproduct waste lead compounds, such as those obtained from storage battery industry, can be converted to lead powder suitable for battery manufacture.

The lead compounds kept as a sediment on the bottom of a mild steel or lead container serving as the cathode act as solid depolarizer. A wire mesh anode suitably disposed over the cathode in an alkaline electrolyte completes the electrolytic cell. The lead compounds get reduced to lead powder on passing the current through the cell. Once the conversion is complete, the powder is taken out, washed, stabilized and dried. The powder is 96%

pure, the only impurity being the oxide. The new process has a number of advantages over the conventional processes. It lends itself to operation of very large capacity cells—conventional electrodeposition processes are not amenable for such operation—and scaling up to any capacity is easy; cells of the order of 10 000 amp can be employed without much difficulty. Maintenance and control of the parameters are simple. The metal powder can be obtained with fairly desired characteristics by suitably modifying the starting material and the conditions of electrolysis. The process is more economical because of the utilization of the electrolyte over and over again with only a slight loss due to the drag-out and handling. As the material is taken as such for conversion and does not involve the preparation of a homogeneous solution for electrolysis, a few intermediary steps are avoided and stringent control of the concentration of the lead ions in solution is not necessary. As the conversion takes place in the solid state itself, formation of coarse aggregates does not occur. The purity of the powder depends on the nature of the raw material.

Lead powder obtained by this process can be used for making not only battery plates but lead alloys. The powder finds application in brazing and soldering industries.

PATENTS FILED

126/Cal/73 : A 25 dm³ precision pipette, M. Nath—NPL, New Delhi.

264/Cal/73 : A catalyst and process for the production of phthalic anhydride by the vapour phase oxidation of *o*-xylene or naphthalene, or mixture of both, S. K. Mukhopadhyay, S. K. Ghosh, T. K. Bhowmik, S. R. Dwivedi, M. Chakraborty, A. N. Basu, N. G. Basak & A. Lahiri—CFRI, Dhanbad.

265/Cal/73 : Improvements in or relating to the recovery of silver from silver waste, M. R. Verma, J. Rai & K. M. Munjal—NPL, New Delhi.

422/Cal/73 : A seeding attachment for tractors, N. M. Singh, S. C. Vohra, A. P. Goel & B. K. Chhabra—CSIR, New Delhi.

374/Cal/73 : Improvements in or relating to colouring of aluminium powder, B. A. Shenoi & T. S. Krishnan—CECRI, Karaikudi.

407/Cal/73 : Improvements in or relating to acidification of sodium phosphate solutions, K. S. Rajagopalan, R. Srinivasan, C. Rajagopal, N. Krithivasan, M. K. Janaki, M. Sethukumari & P. S. Mohan—CECRI, Karaikudi.

547/Cal/73 : Temperature relay in the range 50-60°C, R. Singh & S. C. Banerjee—CMRS, Dhanbad.

594/Cal/73 : Polymerization of silicone oil to high molecular weight products by irradiation technique, S. Subrahmanyam & G. Krishnamurthy—NAL, Bangalore.

668/Cal/73 : Process in or relating to the development of fly ash-sand-lime bricks, M. Rai, S. P. Garg & B. B. Lal—CBRI, Roorkee.

723/Cal/73 : A process for the micro-encapsulation of water-immiscible solids, solvents, dyes, perfumes, mineral oils, vegetable oils and like products, (Mrs) S. Laxmi, S. P. Srivastava, C. N. Saikia, S. A. A. Rizvi & M. S. Iyengar—RRL, Jorhat.

790/Cal/73 : A new promoter-administered, improved catalyst for oxidation of carbon monoxide at ambient temperature, A. K. Acharya, A. K. Ghosh & S. K. Gupta—CMRS, Dhanbad.

838/Cal/73 : Improvements in or relating to coatings for corrosion prevention in reinforced cement concrete constructions, K. S. Rajagopalan & S. Chandrasekaran—CECRI, Karaikudi.

1065/Cal/73 : Improvements in or relating to paint stripper, K. S. Rajagopalan, S. Guruviah & C. Rajagopal—CECRI, Karaikudi.

1073/Cal/73 : Vacuum holding device, C. L. Garg, S. D. Garg & R. S. Kundi—MERADO, Ludhiana (CMERI, Durgapur).

807/Cal/73 : Improvements relating to high-frequency step-attenuators, G. N. Acharya, Inderjeet Singh, S. Mahendroo—CEERI, Pilani.

852/Cal/73 : Synthetic sperm oil emulsion for fatliquoring of leathers, K. J. Kedlaya & K. S. Jayaraman—CLRI, Madras.

894/Cal/73 : Improvements in or relating to prestressing of high strength deformed bars using electrothermal method, A. G. Madhava Rao, V. S. Parameswaran, D. S. R. R. Murthy & G. S. Ramaswamy—SERC, Madras.

994/Cal/73 : Improvements in or relating to the preparation of acyl aziridine suitable for use as textile softeners, K. K. Sharma & A. S. Jaffal—SRIFIR, Delhi.

1012/Cal/73 : A soldering bit for desoldering IC packages and sockets, H. Singh, I. Singh, A. C. Gupta & T. B. Dewan—CEERI, Pilani.

1013/Cal/73 : Improvements in or relating to a device for drawing helical fins over tubes, B. C. Mohanty—RRL, Bhubaneswar.

1064/Cal/73 : A gas lighter, O. P. Bhola—NPL, New Delhi.

1065/Cal/73 : Improvements in or relating to paint stripper, K. S. Rajagopalan, S. Guruviah & C. Rajagopal—CECRI, Karaikudi.

1098/Cal/73 : Improvements in or relating to the electrolytic reduction of nitrobenzene to aniline, H. V. K. Udupa, G. S. Subramanian, P. N. Anantharaman & A. Pourassamy—CECRI, Karaikudi.

1107/Cal/73 : Improvements in or relating to the preparation of new reactive dyes containing azido acetyl amido groups, N. R. Ayyangar, N. V. Badami, B. D. Tilak & E. H. Daruwalla—NCL, Poona.

147/Cal/73 : A process for manufacture of silver graphite compositions, D. Sen—NPL, New Delhi.

186/Cal/73 : Dielectric sample holder for very thin membrane type of materials, (Miss) K. B. Lakshmi—NPL, New Delhi.

200/Cal/73 : A daylight and sunshine indicator, V. Narasimhan & G. D. Bansal—CBRI, Roorkee.

308/Cal/73 : A process for the manufacture of rust preventive packing paper, (Mrs) S. Laxmi & M. S. Iyengar—RRL, Jorhat.

324/Cal/73 : Improvements in or relating to the preparation of new reactive dyes derived from copper phthalocyanine, N. R. Ayyangar, N. V. Badami, B. D. Tilak & E. H. Daruwalla—NCL, Poona.

PATENTS SEALED

122699 : Improvements in or relating to heart beat rate measuring instrument, R. Parameswaraiiah & P. E. Sankaranarayanan—NAL, Bangalore.

123645 : Improvements in or relating to the electrolytic reduction of salicylic acid to salicylaldehyde, H. V. K. Udupa, G. S. Subramanian, K. S. Udupa & T. D. Balakrishnan—CECRI, Karaikudi.

127748 : A process for making multiple prints of a document with an electrophotographic machine, P. C. Mehendru, D. C. Parashar, G. D. Sootha, D. Singh & N. Kumar—NPL, New Delhi.

Journal of Structural Engineering

The Structural Engineering Research Centre, Roorkee, has started issuing a new quarterly under the title *Journal of Structural Engineering* from April 1973. The journal would be a medium for structural engineers in India and elsewhere "to document, discuss and debate current trends in design, research and development relating to all areas of structural engineering". It is devoted primarily to original unpublished research findings and critical state-of-art surveys of areas currently engaging the attention of research workers.

The first issue of the journal (A4 size, pp. 42) contains the following five papers: (1) Design of skew slabs by the strip method; (2) Fully stressed design of variable thickness slabs and column footings by finite element method; (3) Cracked section theory of reinforced concrete folded plates;

(4) Effect of debonded tendons on the end zone stresses; and (5) Effect of axial shortening of columns on moments in multistorey frames. The News and Notes section contains: book reviews; information storage and retrieval system adopted in the journal; and keyword abstracts of papers published in this issue of the journal.

In his foreword to the inaugural issue, Prof. G. S. Ramaswamy (Director, SERC), who is the chief editor of the journal, mentions that from time to time an entire issue would be devoted to a selected theme with contributions from acknowledged leaders in the field and discussions thereon. Two of the themes are: Cracking in reinforced and prestressed concrete structures and design for crack control; and Partial prestressing: research findings and design practices.



भारत की संपदा प्राकृतिक पदार्थ

भारत के प्राकृतिक पदार्थों—वनस्पतियों, खनिजों, प्राणियों के बारे में वैज्ञानिक तथ्यों से परिपूर्ण प्रामाणिक जानकारी के लिए वैज्ञानिक और औद्योगिक अनुसंधान परिषद का सचिव हिन्दी विश्वकोश हिन्दी अकारादि क्रम में 9 खण्डों में प्रकाशित होने वाले इस विश्वकोश के 3 खण्ड प्रकाशित हो चुके हैं। दो पूरक खण्ड: 'मत्स्य और मात्स्यिकी' और 'पशुधन और कुक्कुट पालन' प्रेस में हैं।

प्रथम खण्ड (अ-घ)—लेख: 723; पृष्ठ: 404; चित्र: 150; मूल्य: 62.50 रु.

कुछ प्रमुख लेख: धान, काजू, मूँगफली, शकरकंद, कटहल, सुपारी, इलाइची, लोकाट, तुलसी, अलसी, अस्थियाँ, एम्बेस्टास, अन्नक, आमला, आर्सेनिक अयस्क, ऊँट, कत्था, रीठा, घुंघची।

द्वितीय खण्ड (क)—लेख: 650; पृष्ठ: 446; चित्र: 124; मूल्य: 59 रु.

कुछ प्रमुख लेख: चाय, काफी, कोयला, क्वार्टज और सिलिका, कवक, काँच, काजू, जूट, मांग, पपीता, सनाय, नारियल, कोबाल्ट, कोरंडम, क्रिसेन्थेमम, सन, क्रोमाइट, क्वारकस, क्षारीय-मिट्टियाँ।

तृतीय खण्ड (ख-न)—लेख: 501; पृष्ठ: 450; चित्र: 166; मूल्य: 61 रु.

कुछ प्रमुख लेख: गसिनिया, कपास, ग्रीविया, ग्रेफाइट, सोयाबीन, चूना-पत्थर, जिप्सम, अखरोट, चमेली, भौंगा, चिंगट तथा महाचिंगट, टिट्टियाँ, रतालू, तेंदु, धतूरा, सेम, शीशम, बांस, डोलोमाइट, तामड़ा, निकल अयस्क, तम्बाकू।

विश्वकोश की कुछ विशेषतायें

- वनस्पति विषयक लेख लेटिन नामों के अकारादि क्रम में !
- वनस्पतियों के अन्य भारतीय भाषाओं में प्रचलित नाम !
- जन्तु और खनिज विषयक लेख प्रचलित हिन्दी नामों के अकारादि क्रम में !
- भारतीय भाषाओं के नामों की अनुक्रमणिका !
- अतिरिक्त जानकारी प्राप्त करने हेतु संदर्भ ग्रन्थ सूची !

वैज्ञानिकों, उद्योगपतियों, जनसाधारण, विद्यार्थियों, शिक्षण और अनुसंधान संस्थानों, विकास अधिकारियों, पुस्तकालयों आदि के लिए समान रूप से उपयोगी।



बिक्री और वितरण अधिकारी

प्रकाशन एवं सूचना निदेशालय (पी. आई. डी.)
हिलसाइड रोड, नई दिल्ली-110012



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Seminar on High Alumina Refractories

A seminar on High Alumina Refractories was held under the joint auspices of the Central Glass & Ceramic Research Institute, the DGTD Panel on Refractories and the Indian Refractory Makers' Association on 21-22 May 1973 in Calcutta. The object of the seminar was to take stock of the present position with respect to the availability of technical know-how, production capacity and capability vis-a-vis the requirement of refractories with particular relevance to raw material problems, service performance and availability of imported equipment. Consumers, manufacturers, research workers, design engineers and representatives from concerned government departments participated in the seminar. Twenty-three papers covering different aspects of high alumina refractories were presented and discussed at the seminar. Shri Wadud Khan, Secretary, Steel Authority of India Ltd, and chief guest at the seminar, called upon the participants to lay down certain priorities and draw up a programme of follow-up action. He also emphasized the need for improving the quality of refractories and accelerating import substitution through R & D efforts. Because of the special significance of refractories to the steel industry he stressed the need for establishing closer contact between the steel industry and refractory manufacturers.

Welcoming the participants, Dr S. S. Ghosh, chairman of the organizing committee, said that high alumina

refractories were gaining importance with the increasing industrialization of the country, particularly the rising production of steel, and focussed attention on the non-availability of the right quality of certain raw materials, and of special manufacturing facilities and equipment.

Shri K.D. Sharma, Director, CGCRI, pointed out that the R & D efforts had been instrumental in bringing down the consumption of refractories. High alumina refractories made from natural sillimanite from Khasi Hills (Assam) were comparable to imported, fused cast refractories. He referred to the CGCRI researches on the use of diaspore in making high alumina refractories as well as to the process of making such refractories (containing 95 % alumina) suitable for steel industry. He stressed the need for exploration of Khasi and Jaintia Hills jointly by the Hindustan Steel and the Geological Survey of India with a view to identifying sources of refractory quality raw materials. The Director summed up the discussions held at the seminar.

Course on Exhibition of Achievements of an R & D Institute

A course on how to organize an exhibition of the achievements of a research and development institute was held at the Birla Industrial & Technological Museum, Calcutta from 3 to 13 August 1973. The course was jointly organized by CSIR Museums, the Directorate of Advertising and Visual Publicity and the Calcutta University. Intended for the personnel of CSIR laboratories engaged in setting up, or intending to

set up, individual exhibition units in their laboratories, the course included lectures, practical demonstrations, visits to exhibitions, museums and institutional galleries of the city, group discussions and project work.

Shri C. Subramaniam, Union Minister of Industrial Development and Science & Technology, inaugurated the course. Dr S. N. Sen, Vice-Chancellor, Calcutta University, presided.

Stressing the importance of carrying science and technology to the masses, the Minister, in his inaugural address, called upon the specialists in museology to give serious thought on how the lack of communication between research workers and the general public can be set right through a major campaign for popularizing what science and technology have achieved and in what manner they could further revolutionize our lives. As a first step, our laboratories, he said, should have a programme of mass contacts with the object of establishing a two-way communication between research workers and the general public.

"A new process or a new technique developed after patient research work is not likely to be exploited until there is general acceptance for it, and until the potential users are satisfied that it marks an improvement over a currently known process or technique. Often, one may find that in the process of popularization, certain requirements of the consumer had not been given full attention to by the research worker or the manufacturer and that some change of design or of the functional characteristics is called for. Hence the importance of two-way communication, of effective feedback. This is part of the

larger purpose of educating the masses as to what the new revolution in the scientific world holds out for them in matters of food, clothing, housing, transport, health, education, and the like."

The present programme is only a first step, but an important and essential step, concluded the Vice-President, CSIR.

In all, 16 participants from 13 CSIR laboratories and 18 observers from the Directorate of Advertising & Visual Publicity, the Calcutta University and two CSIR museums participated in the course.

Prof. R. N. Chakravarti, Director, Indian Institute of Experimental Medicine, Calcutta, delivered the valedictory address on 13 August 1973, and Shri K. G. Krishnamurthi, Secretary, CSIR, gave away certificates to the participants of the course.

BTRA's Annual General Meeting

The nineteenth annual general meeting of the members of the Bombay Textile Research Association, Bombay, was held at BTRA on 28 July 1973. In his address, Shri Pratap Bhogilal, Chairman of the Governing Council of BTRA, informed the members that the membership of BTRA had shown a marked increase in recent years due to the very useful services being rendered as well as to the many successful process developments implemented in member mills. He also observed that a number of mills who are members of research associations in their respective zones had also found it useful to become members of BTRA. He further covered the important achievements of BTRA, a brief summary of which is given in the following paragraphs.

Awards for BTRA Processes

The know-how developed in mechanical processing has led to improvement of yarn quality, slashing down of sizing expenses and attainment of higher weaving efficiency. The tempo

of evolving new products and processes continues at a high level. The Inventions Promotion Board awarded shields for import substitution to two BTRA processes: (i) Partial substitution of hydrosulphite in vat dyeing (silver shield), and (ii) Complete substitution of Rongalite in printing (bronze shield).

Implementation of New Processes

Among the recently developed processes and products, the electrolytic process for reducing consumption of hydrosulphite has been in operation in nine member mills, while the 'blend finish' and the 'silk finish' are being marketed by three member mills. In view of its global importance, patents have been filed for the electrolytic process in UK, USA, Federal Republic of Germany, Switzerland and Denmark. The single-stage bleaching process for polyester/cotton fabrics is successfully working in four member mills, and negotiations are in progress regarding export of the know-how to the Arab Republic of Egypt.

New Developments

Some of the more recent developments in which mills have already shown interest are a durable chemical finish to impart softness to 100% polyester sarees, and a fast-acting catalyst which reduces the curing time in printing to 2 min. The consultation services in chemical processing have led to considerable savings through shortening of processing sequences, reduction of water consumption, etc. New finishes and novel effects have also been produced, and new catalyst systems to obtain high durable press properties with low strength and abrasion losses for all-cotton fabrics are being developed.

The commercial model of the BTRA Elcofil sorter is to be marketed in a year's time. The BTRA drapemeter, developed earlier, was used to study the influence of finishing treatments on fabric drape, and a paper on the subject was read at the Twentieth Hungarian International Textile Conference held at Budapest in June this year. As a result of the study, norms for

fabric drape have been made available for the first time in India.

Basic researches relating to moisture relations in polymers, location of crosslinking sites in cotton, etc. have made considerable progress and a process to improve cotton yarn strength is being developed.

Surveys

In the field of operations studies, several important surveys on productivity, stores, financial performances, etc. have been completed. Training programmes, conferences and seminars were also conducted with greater participation from the industry.

Concluding the speech, the retiring Chairman made an appeal that more mills should join BTRA and avail themselves of the benefits since no mill could afford to overlook any area of cost reduction in the present status of the industry. He thanked the members and his colleagues in the Governing Council for their excellent cooperation, and extended his best wishes to the incoming Chairman Shri Radhakrishna R. Ruia and the Deputy Chairman Shri H. R. Batlivala.

Prof. E. H. Daruwalla, Research Adviser to BTRA, and Director, University Department of Chemical Technology, and Shri T. V. Ananthan, Director of BTRA, also addressed the members.

A three-day exhibition on BTRA's new developments was also organized on the occasion (30 July to 1 August 1973).

New Current Awareness Service by RRL, Jorhat

A mimeographed list of current titles of research and review papers and general articles of relevance to its work is being brought out by the Regional Research Laboratory (RRL), Jorhat. This current awareness service, intended primarily to serve the research workers of this laboratory, could be of considerable use to research workers elsewhere. The list covers articles in the following disciplines and areas of work in which the laboratory is engaged: Pulp, paper, cellulose and board;

Silicate; Coal; Petroleum; Organic chemistry; Biochemistry; Botany; Analytical chemistry; Chemical engineering; Civil engineering; Design; Elec-

tronics and instrumentation; X-rays, and Generalities. The first issue of the list, issued in July 1973, contains 266 entries.

PROGRESS REPORTS

CSMCRI Annual Report : 1972

The Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar has brought out its annual report for 1972 in which the progress in research and development activities is set out projectwise under four major areas of work in which the institute is engaged, viz. Salt and marine chemicals; Desalination; Marine algology; and Sea-water iriculture. Thirty-six projects in all were investigated during the year.

Processes for the manufacture of iron and calcium fortified salts were developed. Calcium iodate proposed for iodization of coarse crystalline common salt has been approved as available to human system.

Recovery of crystalline magnesium chloride by solar evaporation of bittern was carried out under the climatological conditions prevailing at Bhavnagar and 1.5 tonnes of crystalline magnesium chloride were supplied to the Central Electrochemical Research Institute, Karaikudi for testing its suitability in the manufacture of magnesium metal.

A process was worked out to utilize kainite and carnallite type mixed salt to obtain schoenite and potassium chloride as two separate products. Based on the process developed by the institute, a bench scale plant for producing 24 kg per day of potassium nitrate from ammonium nitrate derived from CAN fertilizer and potassium chloride was set up and operated successfully for one month. A process for the preparation of potassium silicate from sodium silicate and potassium chloride using a strongly acidic cation exchange resin Zeocarb 225 was developed under a sponsored project. Processes were also developed for the preparation of ammonium bromide and iron alums from iron bromide

using a cation exchange resin and for the recovery of zinc from zinc-lead-copper-iron sulphides. Bench scale work on the preparation of EL grade boric acid from technical grade borax using ion-exchange technique was completed.

Studies on the recoveries of iodine from seaweeds and from the waste cake of the seaweed-based industries revealed that 2 tonnes of seaweed (dry) yield 1.8-1.0 kg of iodine besides 200 kg of potash salt. Large scale experiments with 225 kg of seaweed ash were in progress.

Studies on atmospheric corrosion at marine and industrial-cum-marine sites at Mithapur showed that the corrosion rate was not directly proportional to the concentration of the pollutant gases but increased greatly with increase in humidity.

Work was continued on desalination of sea-water and brackish water by four techniques, viz. distillation, reverse osmosis, ion-exchange and freezing. A solar still was fabricated from Thermocole slabs. Work was carried out with spiral, corrugated aluminium tubes in heat transfer studies, and methods were developed for the fabrication of spirally corrugated tubes. Studies to prevent scale formation in sea-water desalination by distillation showed that in sea-water containing up to 11% solids in the discharge brine, the scale formed in the presence of an additive consisting of sodium hexametaphosphate and linseed in the proportion of 30 : 70 at a concentration of 15-25 ppm in sea-water was quite soft and could be removed easily from the tubes. Evaluation of the additive is in progress and other additives are being screened.

Cellulose acetate dense membranes were prepared and were grafted with

styrene by gamma irradiation, and their physical properties and performance were studied. Membranes were prepared from blended formulations of di- and tri-cellulose acetate and their physico-chemical characteristics were determined. At the instance of the Unichem Laboratories, a reverse osmosis tubular plant (capacity, 2500 litres/day) was fabricated for the separation of sodium chloride from the iron-dextran solution.

Electrodialysis stacks with interpolymer membranes were fabricated for desalination of brackish and saline water in arid zones of Gujarat and Rajasthan. A continuous countercurrent ion-exchange water softening technique has been developed for the first time in the country using entirely indigenous components and resins. Inorganic ion-exchangers of interest to the Bhabha Atomic Research Centre for waste treatment and other uses were prepared and supplied for trials.

In the field of marine algology, work on the survey of marine algal resources, cultivation of economically important seaweeds and utilization of algal resources was continued. Details of the techno-economic feasibility of cultivation of *Gracilaria edulis*, an agaro-phyte which can serve as an alternative source of agar-agar in the country, have been worked out. The yield and quantity of agar from the cultivated material is comparable to those of *G. acerosa*, the more commonly employed seaweed. Screening of seaweeds for proteins, peptides and amino acids has been completed. Considering the raw material position and quality of essential amino acids composition, it is worth exploiting *Gracilaria* and *Hypnea* for agaroids, proteins and amino acids, and *Sargassum* for industrial chemicals like chlorophylls, alginates, mannitol, β -carotene and amino acids.

Screening of 20 varieties of genetic germ plasm stock of sugar-beet was carried out to assess relative tolerance in sea-water salinity. Varieties USH-9 and Kawe gigapoly proved better yielders. Their sugar content ranged from

10 to 12.5%, comparable to that of the normal crop. Cotton crop was also tested for sea-water (10 000 and 15 000 ppm salinity) tolerance and it was observed that the variety IAN-579/1327/2749 had no significant reduction in the yield of cotton bolls up to 15 000 ppm. Studies on the propagation of *bajra* to avoid the necessity of fresh-water irrigation of initial stages of growth showed that transplantation after 30 days of growth did not require fresh-water irrigation, and an increase in yield of grains (6-7 quintals per hectare) under direct sea-water application on cessation of rains was obtained.

Three patents filed during the year relate to : (1) process for the production of high-purity water by solar stills ; (2) spirally enhanced tubes of high heat transfer for heat exchangers ; and (3) improvements relating to the device for conducting chemical conversions using electrodialysis technique. Forty research papers were published during the year.

Two CSMCRI processes, viz. manufacture of potassium carbonate and N-K fertilizers by ion-exchange technique and manufacture of agar-agar from seaweeds received the awards of the Inventions Promotion Board.

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

2,2,4-Trimethyl-6-ethoxy-1,2-dihydroquinoline

Used as an antioxidant in rubber industry 2, 2, 4-trimethyl-6-ethoxy-1, 2-dihydroquinoline is being manufactured in the country by a firm whose annual production is reported to be of the order of 50-100 tonnes. Exact data on the import or total demand for this product in the country are not available. It is, however, estimated that the demand in future may be around 500 tonnes per annum.

The National Chemical Laboratory, Poona has developed a process for the manufacture of this antioxidant. The process consists in condensing *p*-phenetidine with acetone in the presence of a catalyst and purifying the product. The process conditions have been standardized on 1 kg per batch scale of the finished product. The product has been tested and found to conform to the required standards. Its performance is comparable with that of the imported material.

p-Phenetidine, acetone, catalyst and solvent are the main raw materials required for the manufacture of the antioxidant. Of these, *p*-phenetidine will have to be imported for the time being. Although it is being produced by the Indian Drugs & Pharmaceuticals

Ltd, Hyderabad, the entire quantity is being consumed for their captive use. A process for the production of *p*-phenetidine has also been developed by NCL, Poona on a sponsored basis.

Glass-lined reactor, vacuum pump, distillation assembly and storage vessels are the important items of plant and equipment. These are either available in the country or can be fabricated indigenously.

The laboratory has assumed a 100 tonnes per annum plant as the optimum economic size unit. The capital outlay for a plant of this size is estimated at Rs 14.99 lakh (a fixed capital on building, plant and equipment of Rs 7.80 lakh and a working capital of Rs 7.19 lakh). The cost of production comes to about Rs 17 per kg.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Furfural

Furfural is a solvent which is in great demand by petroleum industry for separating saturated compounds from unsaturated compounds, and for refining lubricating oil, gas oil and diesel fuels. It also finds wide application — refining of vegetable oils, as

an ingredient in making phenol-furfural resin; as a decolorizing agent for wood resin; as a resin solvent and wetting agent in the manufacture of abrasive wheels and brake linings; in extractive distillation of butadiene and other C-4 hydrocarbons for the manufacture of synthetic rubber; and in the manufacture of other furan and tetrahydrofuran compounds.

Indigenous production of furfural is very low and some 6000 tonnes are being imported annually at a cost of about Rs 4000 per tonne. The open market price for furfural varies between Rs 6 and 20 per kg.

Although the future demand for this chemical has not been estimated with certainty, there is bound to be great demand with the increase in capacity of lubricating oil production, manufacture of synthetic resin and rubber.

The Regional Research Laboratory (RRL), Jorhat, has developed a process for the production of furfural using agro-industrial wastes like bagasse, saw dust, corn-cobs, and paddy husk as the raw material. The product developed on a laboratory scale has the following specifications : boiling point, 162°C at atm pressure; density at 30°, 1.156; and refractive index, 1.522.

The process briefly consists in : (i) crushing and air-drying of the raw materials ; (ii) hydrolysis of the mass at room temperature with dilute sulphuric acid ; (iii) heating of the hydrolyzed material in a reactor to 250°C with fuel gas ; (iv) sweeping of the furfural formed between 150 and 250°C using steam or an inert gas ; (v) condensing of the vapour and stripping ; (vi) separation of furfural and water from the lower layer ; (vii) recycling of the upper layer which is a saturated solution of furfural for further recovery; and (viii) dehydration of the bottoms to get the pure product.

A small quantity of methanol is obtained as a byproduct and acetic acid is left in the residue. The uses of acetic acid (in the production of acetic anhydride) and methanol are well known.

The raw materials required are bagasse, saw dust, and corn-cobs; and are available indigenously.

The main items of equipment are : mixer (sprayer type) to handle 100 tonnes per day of raw material, stainless steel reactor with mild steel flue chamber, air blower, feeding and discharge devices, stainless steel coolers, stainless steel vapour condensers, reflux distributor, volatiles column, drying column with condenser, vacuum pump and other pumps, boiler, and distillation column. All the equipments can be manufactured in India.

The suggested optimum plant capacity is 5 tonnes per day. The fixed capital for a 5-tonne per day plant is estimated at Rs 24 lakh, and a working capital of about Rs 11 lakh. The cost of production is estimated at Rs 2000 per tonne. The raw material requirements are as follows : bagasse, etc., about 20 tonnes per tonne of furfural ; and sulphuric acid (75% conc.), 0.5 tonne per tonne of furfural.

Sufficient data are available with regard to optimum reaction conditions with different raw materials, nature of reactor, heat transfer data, distillation characteristics of furfural in water mixture of different concentrations, etc.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Alchrome-U

Chrome-tanning, neutralization, fat-liquoring and re-tanning of leather—all these four different operations in leather processing—can now be done in one stage using the latest product 'Alchrome-U' developed by the Central Leather Research Institute, Madras. The process for the production of Alchrome-U is simple and consists of the physical blending of the raw materials like basic chrome extract, oils and some chemicals in a stainless steel kneader. The capital investment is very low and the product can be produced at a cost of about Rs

6.50 per kg. Produced on pilot plant scale, Alchrome-U has been extensively used in a tannery with very good results for hair-on tanning.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Siliconized Oil based Fat Liquors

Sulphated fat liquor is used by the leather industry to the extent of about 1000 tonnes per year for improving the properties of leather. A product superior to the sulphated fat liquor, which imparts smooth 'easy slip' feel to the leather surface, has been developed by the Central Leather Research Institute (CLRI), Madras.

The new product is the siliconized oil based fat liquor, and is prepared by treating fish oil or castor oil with silicone monomer and is subsequently sulphated with sulphuric acid and washed with brine. The estimated future demand for this product is about 1500 tonnes per annum.

Developed in the laboratory and scaled up to the pilot plant scale the process has become a technical and economic feasibility. With no extra capital investment, the manufacturers of syntans or leather auxiliaries possessing glass-lined equipment can manufacture the new product. An investment of Rs 1 lakh may be required on raw materials. If the process is taken up by manufacturers of fat liquors, an additional Rs 1 lakh will be required on equipments. The present market price of sulphated fat liquor is about Rs 4.50 per kg. The cost of production of siliconized oil based fat liquor may be about Rs 6.80 per kg.

The raw materials, viz. fish oil or castor oil, sulphuric acid, caustic soda, and sodium chloride, are locally available. Silicone monomer may have to be imported. An optimum plant capacity of 100-150 tonnes per annum is suggested.

Further particulars may be obtained from : The Managing Director, Natio-

nal Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Urethane Varnish based on Castor Oil

The higher the gloss the higher the value of a leather product. To get the finish required in leather goods, the industry uses at present about 80 tonnes of top coat lacquers annually, of which 5 to 10 tonnes are urethane lacquers (imported). As Indian footwear and leather goods are in great demand both locally and abroad, it is expected that about 25 tonnes of urethane varnish, valued at Rs 6 lakh in foreign exchange, may be required in the near future.

The Central Leather Research Institute, Madras has developed a urethane varnish based on castor oil, which has made a significant contribution to the leather and leather goods industry. The leathers finished with this latest varnish have passed the test specified by ISI. Besides good gloss, the varnish gives the leather good protection, and a highly water-resistant, smooth, flexible and polishable finished surface.

The varnish can be prepared by reacting toluidine diisocyanate and castor oil in a solvent medium (xylene or butyl acetate) in reaction kettles fitted with necessary auxiliary equipments. The process is simple, easily controllable and is completed in a period of 4 hr. With a capital outlay of about Rs 1.65 lakh, the varnish can be produced at a cost of Rs 17 per kg, which will give a high margin of profit to the producer. The cost may be reduced to Rs 10 per kg as the recent imported cost of toluidine diisocyanate is only Rs 8 per kg. Castor oil and xylene are available in the country. Only toluidine diisocyanate needs to be imported for a year or two. The reaction kettle and the auxiliaries can be manufactured easily.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

CSIR SUPPORT TO RESEARCH

Completed Schemes

Role of Mucous Cells in Osmotic Adaptation of Fish

The role of mucous secreting cells in the osmotic adaptation of a freshwater fish, euryhaline teleost (*Tilapia mosambica*), acclimatized to hetero-osmotic media, has been studied by Dr C. Narasimhan, a CSIR research fellow, who worked at the Zoology Department, S. V. University College, Tirupati, from January 1972 to April 1973. As the gill, kidney and intestine are known for their direct role in osmoregulation, the study was limited to these organs. The fish were acclimatized to 25%, 50%, 75% and 100% sea-water media and the mucous cell activity was measured in gills, intestine and kidneys in each of these acclimation media.

The results suggest that in lower salinities the mucous cells in the gills may check the entry of water into the fish to facilitate hyperosmotic regulation. In higher salinities, most of the mucous cells may transform themselves as chloride cells, resulting in a substantial increase in the number of chloride cells and a substantial decrease in the number of mucous cells in the gills of fish adapted to higher salinities. In the intestine the number of mucous cells increased in higher salinities, presumably to protect the delicate intestinal epithelium from the adverse effects of salt water.

Kinetics and Mechanism of Oxidation of Amino Acids

The oxidation of some monocarboxylic monoamino acids like glycine, alanine and valine, and monoamino dicarboxylic acids like aspartic and glutamic acids with peroxydisulphate, chromic acid and solid MnO_2 has been studied by Shri Govind Chandra, a CSIR research fellow, who worked at the Chemistry Department, Agra College, Agra, from January to November 1972.

Peroxydisulphate oxidation of these amino acids was also catalyzed by

silver ion. The acids are degradatively oxidized to the aldehydes. They also show the common features of peroxydisulphate oxidation, i.e. the reactions are first order in peroxydisulphate and independent of organic substrates. Silver ion shows a linear relationship with rate constant. These are chain reactions and are inhibited by chain scavenger allyl acetate. However, the main difference between monoamino monocarboxylic acid and monoamino dicarboxylic acid oxidation is that in the first case the formation of hydrogen-free radicals takes place while in the latter case the amino acids yield CO_2 -free radicals. Very low yields of aldehydes indicate that some secondary reactions also take place as proved by a study of the oxidation of glutamine and asparagine. In these cases, aldehydes were not detectable and the evolution of NH_3 occurred. It was therefore concluded that the ammonia, which is also an oxidation product, reacts with aldehydes to retard their yields and thus in the cases of glutamine and asparagine where the evolution of ammonia is large, the whole of the aldehydes was consumed by it to form aldehyde-ammonia.

The amino acid oxidation by chromic acid was followed colorimetrically — change in the colour of the solution from yellow to green in perchloric and sulphuric acid medium.

The oxidation studies were also made using solid MnO_2 in H_2O and in other organic solvents. The amino acids were oxidized to aldehydes (containing one carbon atom less than the parent acid) with the evolution of NH_3 and carbon dioxide.

Evolutionary Trends in High Grade Metamorphites

Some of the tracts of the Eastern Ghats in Krishna, Guntur and Ongole District of Andhra Pradesh have been examined in detail with a view to ascertaining the evolutionary trends in the high-grade metamorphites. The investigations were carried out by Dr A. Ramaswamy, a CSIR research

fellow, working in the Department of Geology, Sri Venkateswara University College, Tirupati. Khondalite Series constituting garnet-sillimanite gneisses, calc-gneisses and quartzites and the Charnockite Series constituting the pyroxene granulites (basic) and charnockites (*sensu stricto*) are seen in intimate association with each other. This association has actually led many investigators to consider the Charnockite Series also as metasediments. This conclusion is at variance with the observations made in the investigations made in the aforementioned areas.

The two members of the Charnockite Series, pyroxene granulites and charnockites, are not genetically related to each other and are also separated chronologically, the charnockite being always younger than the pyroxene granulite. Again, the origin of pyroxene granulite shows two derivations, viz. metasediments (Ongole Dist.) and basic volcanics (other areas). However, the charnockite seems to be always igneous, whether magmatic or anatectic.

The association of Charnockite Series of rocks with Khondalite Series of rocks can be considered to represent an argillaceous sediment-dolomite association or argillaceous sediment-volcanics association. These premetamorphic associations experienced intense deep-seated metamorphism (granulite facies grade), resulting in the Khondalite Series-Charnockite Series association, observed in the area under investigation. Subsequently, the charnockites intruded into the association. The charnockite being magmatic is borne out by the contact metamorphic effects noted in certain of the pelitic xenoliths. The pelitic remnants in charnockites contained cordierite, besides its normal mineral assemblage. The absence of cordierite in the actual pelites and its presence in the xenoliths is an unequivocal evidence for the charnockite being magmatic. The mineral assemblage noted in the pelitic xenoliths correspond to the grade of contact metamorphism of pyroxene hornfels facies.

The X-ray study of the cordierite has revealed that it is a normal cordierite, rich in magnesium. The magnesium-rich nature of the cordierite conforms to the high temperature features noted in the contact aureoles.

Most of the X-ray patterns of the orthopyroxenes of pyroxene granulite and charnockites indicate that they are of enstatite-hypersthene range. The similarity of the composition of the pyroxene in both the members of the Charnockite Series may give clue to their formation at similar pressure-temperature conditions, though the two units are separate both in time and space.

X-ray studies of the potash feldspars have conclusively indicated a monoclinic ancestry to them. There is also an indication that the potash feldspar may be of sanidine type (to be confirmed). Presuming the potash feldspar to be sanidine, the parent material may be considered as acid volcanics, namely rhyolites, etc. If this observation comes true, it is a distinct contribution to the evolutionary history of the charnockites of these parts of the Eastern Ghats.

To sum up, the argillaceous basic volcanic association had experienced regional metamorphism (pyroxene granulite facies grade) resulting in the khondalite-charnockite association. These in turn are intruded by charnockites and also subsequently by granites. The charnockite intrusives gave rise to cordierite-bearing pyroxene hornfels and the granite intrusives to retrograde products of Khondalite Series and Charnockite Series.

PATENTS ACCEPTED

Indian Pat. 129107

Improvements in or relating to fuel burning devices

K. S. Narasimhan, B. P. Das & A. Basu
RRL, Bhubaneswar

Fuel burning devices vary in design and construction depending upon the nature of the fuel, which may be a gas, a liquid or a pulverized solid. Each system has its own advantages; for example, a gaseous fuel is very convenient

to handle and a simple device is sufficient, whereas a liquid or a solid fuel having the advantage of providing a highly radiating flame requires additional facilities for burning. It often becomes desirable to have a flexible device in order that one could easily change over from one type of fuel to another to meet the seasonal fluctuations and also to utilize the advantages of either or all of the systems. For example, burning a mixture of coal and oil in the blast furnace tuyers reduces the consumption of the valuable liquid fuel. Burning of up to 10% of carbon black in fuel oil increases the heat radiation by 15% over a system burning fuel oil alone. But in the hitherto reported system for the burning of solids and oil, the storage of solids suspended in liquids has posed a problem which requires compulsory grinding of solids to submicron sizes and as a result there is increased power consumption.

The above-mentioned difficulties are overcome in the burner covered by the patented invention under reference. In this device, gaseous, liquid or solid fuels burn either individually or simultaneously without any major change in the set-up. Either the liquid fuels are atomized, or the solid fuels ground, or a combination of both is used in the burner. The energy for these operations is derived by the compressed air supplied to the burner which forms part or whole of the primary air required for the combustion of the fuels. The device consists of a feed injection system into which liquid or solid fuels or a mixture of them suitably prepared is introduced through the feeder and conveyed by part of the primary air introduced through a pipe along with or without any gaseous fuel to the main cylindrical chamber. The rest of the primary air compressed at 25-100 psi or more is introduced through the outer chamber surrounding the main cylindrical chamber and expands through nozzles arranged along the circumference of the main chamber. In this chamber, grinding of solid fuel, atomization of liquid fuel and intimate mixing of all the

constituents are achieved as the fuels conveyed into the chamber spread over the wake of expanding air-jets through the nozzles. Thus, compressed air after expansion through the nozzles and performing mixing/grinding of solid/liquid fuels comes out in the form of prepared mixture through an outlet at the bottom of this chamber and is conveyed to the furnace chamber through a pipe and usually ignited with the help of a suitable pilot flame. The design further incorporates a facility to supply secondary air through another pipe.

The device can be fabricated with conventional materials of construction such as mild steel and high-carbon steel.

By adjusting the pressure and quantity of air supplied through the nozzle, it is possible to regulate the droplet size of the liquid fuels and the particle size of solid fuels to control the flame length and combustion intensity in the furnace chamber.

Indian Pat. 133261

Device for cold starting of I. C. engines by priming starter fluid

R. B. Gupta
IIP, Dehra Dun

Starting of internal combustion engines at low temperatures of $+6$ to -40°C , obtaining in the Himalayan ranges, especially in the winter season, poses considerable difficulties. One of the well-known methods of cold starting of I. C. engines under low temperature conditions is to use a volatile fluid, such as diethyl ether, which also has low self-ignition temperature. Best results are obtained when the fluid is sprayed in an atomized form into the engine inlet manifold at the time of cranking. Some vehicle operators pour the starter fluid into the inlet manifold which accumulates in the induction system and makes the starting erratic and difficult at extremely low temperatures. Moreover, it is inconvenient for anyone to come out of the vehicle in such an uncomfortable weather for operating the vehicle. Some aerosol type capsules imported as well as manufactured in the country were

tested under the cold room temperature conditions. As the temperature decreases, the pressure also decreases and as a result, the pressure in the pressurized capsules at low temperatures becomes inadequate to provide any fluid spray, even though sufficient fluid is in the capsule. This results in wastage of the fluid.

In some vehicles, an imported device, Start Pilote, is also being used. This device was tested in cold room conditions at the Indian Institute of Petroleum (IIP), Dehra Dun, for starting a diesel engine. The capacity of the capsule is insufficient even for one start of a commercial diesel engine at -25°C . It delivers the fluid in the form of thin stream rather than as a fine spray. Periodic jamming of the pump and damage to the rubber O-ring of the plunger were also observed.

The patent relates to a device developed for cold starting of I. C. engines by priming starter fluid. The device was tested under simulated conditions (up to -35°C) and also under actual operating conditions of temperatures (as low as -18°C) in high-altitude areas (this was the lowest temperature that could be obtained during the trial period). With this device, vehicles could be started quickly. Moreover, this device delivers the starter fluid in a finely atomized form, requiring a lesser quantity of fluid for each start, convenient to use from within the driver's cabin; one charge may be used for several starts. The device can be easily manufactured indigenously in any reasonably equipped workshop.

PATENTS FILED

325/Cal/73 : Improvements in or relating to the preparation of new reactive finishing agents for textile fibres, N. R. Ayyangar, A. G. Lugade, B. D. Tilak & E. H. Daruwalla—NCL, Poona.

1172/Cal/73 : A process for the preparation of humidity detector tube, K.K. Acharyya—CMRS, Dhanbad.

1173/Cal/73 : A new flake ice maker, H. A. Siddiqi—CMERI, Durgapur.

1234/Cal/73 : Improvements in or relating to the preparation of magnesium fluogermanate red phosphor, C.V. Suryanarayana, M.I.A. Siddiqi, N. Rajaram, R.L. Narayan & V. Sundaram—CECRI, Karaikudi.

1235/Cal/73 : A process for the manufacture of perfumery grade geraniol from oil of palmarosa, S. C. Datta, M. C. Nigam & R. N. Lal—CIMPO, Lucknow.

1399/Cal/73 : An improved process for the preparation of total alkaloids of belladonna and *Datura stramonium*, K. Handa, T. Singh & K. D. Sharma—RRL, Jammu.

1400/Cal/73 : A new process for the manufacture of linalool for oil of *Mentha citrata*, S. C. Datta, M. C. Nigam & T. Sen—CIMPO, Lucknow.

1418/Cal/73 : A cold process for production of berberine hydrochloride from *Berberis* roots, S.C. Datta, M.C. Nigam, O.P. Virmani & M.S. Siddiqi—CIMPO, Lucknow.

1429/Cal/73 : Improvements in or relating to the system for cleaning of machine components in oil, C.L. Garg & R. S. Kundi—MERADO, Ludhiana (CMERI, Durgapur).

1477/Cal/73 : Improvements in or relating to the preparation of electrolytic chromium powder, R. Srinivasan, K. Naganathan, P. Adaikkalam, P. Ramachandran & V. Aravamuthan—CECRI, Karaikudi.

1478/Cal/73 : Improvements in or relating to calcium tungstate blue phosphor of different shades, C. V. Suryanarayana, M.I.A. Siddiqi, N. Rajaram, R. Lakshminarayanan & R. Kalyanasundaram—CECRI, Karaikudi.

Get-together of CECRI Scientists and Industrialists/Entrepreneurs

A get-together of scientists and industrialists/entrepreneurs is being organized by the Central Electrochemical Research Institute, Karaikudi on 4 November 1973 at its Madras Unit, CSIR Madras Complex, Madras. The object of the get-together is to apprise industrialists and entrepreneurs of

the expertise and facilities the institute has built over the years and to invite their suggestions in formulating the future programme of work. Dr H. V. K. Udupa, Director, CECRI, will present a key paper highlighting the achievements of the institute and indicating the future programme of work in the following areas of electrochemistry in which the institute is engaged : (1) Industrial electrolytic cells for production of organic and inorganic products; (2) Electrometallurgy and electrothermal production of industrial materials; (3) Electroplating and metal finishing; (4) Production of batteries—primary and secondary—for practical application; (5) Corrosion prevention; (6) Solid state electrochemical devices; (7) Basic studies in electrochemical science and technology.

Intending participants may obtain further details from : Dr H. V. K. Udupa, Director, Central Electrochemical Research Institute, Karaikudi 623003.

Documentation & Reprography Training Course

The following candidates have been declared successful in the training course in Documentation and Reprography conducted by the Indian National Scientific Documentation Centre, New Delhi during 1971-72, and have qualified for the award of Associateship in Documentation and Reprography :

Distinction

A. K. Roy (Central Glass & Ceramic Research Institute, Calcutta)

First Division

K. A. Raju (National Geophysical Research Institute, Hyderabad); S. S. Puranik (private); S. K. Roy (Indian School of Mines, Dhanbad); B. K. Raju (Indian Institute of Technology, Kharagpur); and N. Jayaraman (Structural Engineering Research Centre, Roorkee).

Second Division

John Verghese (private); and (Miss) Arati Kar (Utkal University, Bhubaneswar).



MYSORE-2A

16 OCT 1973

Summer School on Science Policy Studies

Under the joint auspices of Unesco and CSIR, a summer school on Science Policy was held at the India International Centre, New Delhi from 23 to 28 July 1973. Scientists engaged in science policy studies in India as well as advanced countries (USA, UK, Canada, FDR and GDR) and developing countries (S. Korea, Indonesia, Sri Lanka, Afghanistan, Bangladesh and Thailand) participated in the school. The school was a sequel to the second meeting of the International Commission on Science Policy Studies held in New Delhi from 18 to 21 July 1973. A sizable number of participants representing government departments, R & D establishments, universities and defence services discussed papers and country reports, specially contributed for the occasion.

The school was inaugurated by the Minister for Industrial Development and Science & Technology, Shri C. Subramaniam. Tracing the evolution of a policy for science in India, Shri Subramaniam dwelt on socio-political interactions of science at different stages of development of the country. The government attached much importance to the application of science and technology to the economic growth of the country and therefore it was but opportune that scientists were involved in framing a definitive policy, and a plan of action within that framework, for science and technology. This, in fact, was the guiding principle behind the contribution of the National Committee on Science & Technology which was at that time finalizing a national science plan for India.

Initiating the proceedings of the school with a welcome address, Dr Y. Nayudamma, Director General, Scientific & Industrial Research, announced the establishment of a cell for Science, Technology and Development in CSIR with a view to concentrating on studies of problems relating to development of science and technology in the developing countries.

In his remarks, Dr Derek Price, Chairman of the International Commission on Science Policy Studies, stated that India had decidedly proved its competence in the field of science policy studies and was considered one of the pioneers in the field, particularly with regard to the problems of developing countries. In his opinion, there was adequate talent in the country but it was being underutilized.

Papers presented at the school included: (1) Quantitative methods in science policy studies (Derek Price, USA); (2) Theoretical problems of science policy (G. Krober, GDR); (3) International scientific cooperation, foreign policy and national participation in international scientific cooperation (Brigitte Schroeder, Canada); (4) Science policy and participation in international institutions (E. Skolnikoff, USA); (5) The history and social studies of science and social responsibility and the scientist (Roy MacLeod, UK); (6) Science policy in Asia—CASTASIA with reference to hopes and reality (B. D. Nag Chaudhury, India); (7) Role of multinational corporations (K. K. Subramaniam, India); (8) Social and cultural factors in the development of science with

particular reference to developing countries (S.C. Dube, India); (9) Role of scientific, academic and professional bodies in shaping science policies (B.V. Rangarao, India); and (10) Country reports on the present structure of science and technology, including role of agencies in policy making (by delegates from Bangladesh, Indonesia, Korea, Sri Lanka and Thailand).

In his paper entitled 'The need for the choice and assessment of technology', A.K.N. Reddy (India) discussed the need for development of alternative technologies by the developing countries. He emphasized that the technologies were rarely available in advanced countries and hence would have to come out of indigenous efforts alone. The alternative technology should be capital- and energy-saving, and employment-generating; should promote cottage and small-scale production of goods of mass consumption; should require little skill or small modifications in the skills of traditional craftsmen; should be based on local materials and local sources of energy; should lead to scaled-down dispersable miniaturized factories and thus lead to symbiotic and mutually reinforcing dependence of metropolitan industry on the rural sector.

It was also emphasized that the adoption of alternative technologies would not only lead to reduction of income disparities and improvement in the balance of payment, but also have the following spin-off benefits: (1) Development of alternative technologies would bypass the most important weakness of R & D institutions in developing countries, viz. the weakness in that aspect of the innovation

chain concerned with scaling up. (2) R & D bill for the development of alternative technologies was reasonably certain to be a small fraction of the cost of achieving self-reliance in classical capital- and energy-intensive, large-scale technologies. (3) A commitment to alternative technologies would result in science and its methodology being brought to the rural populations. The resulting dissemination of the scientific temper would have far-reaching effects on social transformation.

A. Rahman (India) discussed in his paper the problems of science and technology in developing countries. He raised the problems of science and technology as seen by a research worker participating in the development of science in a developing country. He felt that the perception of scientists and technologists in developing countries was narrow and limited. This, therefore, inhibited science and technology to take roots in developing countries. Lack of critical analysis of the development of science and technology and, therefore, of the understanding of the process that generated the links for the development of science and technology, was a serious handicap for developing countries. There was a tendency in these countries to view scientific developments in isolation from the social and political developments taking place. This compartmentalized approach led to imbalances and only partial solutions to the problems. This could be illustrated through the study of the developments in the field of health and agriculture. The net impact of various health programmes was the lowering of death rates, without commensurate success in the lowering of birth rates. This was because the two programmes were considered in isolation, leading to faulty priorities. The result, therefore, was population explosion.

The developing countries were also exposed to the pressures and fashions of the academic world of the developed countries. The vicious hold of multinational corporations and dumping of

obsolete technologies through the so-called benevolent programmes of technological aid and foreign collaboration helped increase confusion in developing countries. These countries, therefore, needed to develop their science policy studies which could analyze each one of these aspects in depth and offer options to the decision maker. Social implications, and political changes necessary for each option along with economic aspects of each alternative, should be clearly worked out so that the decision maker became aware of what he was doing.

Analyzing the historical developments of science and technology, Rahman pointed out that science and technology at various intervals of time had stood up against—in fact, fought effectively and curbed—the evils of feudal systems. Situations might not be the same in the modern world; yet there were forces which science and technology would and should be expected to overcome—hunger, disease, quality of life, environmental conditions, depletion of natural resources and unprecedented, unplanned technological development. It was the duty of science policy students to take up these problems and bring to fore issues involved so that scientists in general and decision makers in particular were made aware of them.

On the penultimate day of the summer school, Prof. S. Nurul Hasan, Minister of Education, Culture and Social Welfare, spoke on the problems of education, particularly scientific and technical, and proposed steps to improve the conditions during the Fifth Plan period. Prof. Nurul Hasan stressed on the need for teaching of science to primary sections in order to raise a generation of science-conscious citizens.

Some of the important recommendations made at the school follow :

(1) Summer schools should be held periodically (once a year or at least once every two years). One of the participating Asian countries could organize the school.

(2) The delegates to these schools may be chosen from students as well as

administrators besides from those who are engaged in science policy studies.

(3) The summer schools should concern themselves with the problem of formulating a proper science policy and their promotion and implementation. This may cover discussions on analytical techniques, and details of methodologies. Special case studies may also be commissioned in specific areas.

(4) In order to promote science policy studies : (i) suitable university level courses be prepared; (ii) a half yearly or at least yearly bulletin on science policy matters be brought out; (iii) small working groups in science policy be formed in each country and these be in contact with an overall coordinating agency; and (iv) association for promotion of social responsibilities amongst scientists be sponsored.

The delegates also suggested the following specific areas of science policy studies : (1) Technology transfer : selection and adaptation; (2) Alternative technologies; (3) Model studies in-depth studies of both the consumer industry-based model and the producer industry-based model, and/or various possible mixes of these in the context of the economies of developing countries; (4) Policies for agricultural development and mechanization at the grass-roots level; (5) Evaluation, implementation and formulation of science policy, particularly in the context of a given national policy; (6) Methods and techniques for determining priorities for scientific and technological development; and (7) Manpower studies.

Maturation of Red Blood Cells

The human red blood cell is formed in the bone marrow but attains maturity in circulation after shedding the nucleus. The differentiation involves degradation of the reticulocyte membrane accompanied by loss of enzymic activity, particularly the activities concerned with protein synthesis and glycolysis. Reticulocytosis is stimulated by chemicals such as phenylhydrazine and a number of drugs that cause hemolysis. The transformation of

reticulocyte into the fully mature RBC is under the control of erythropoietin, vitamin B₁₂, folic acid and minerals. The molecular mechanisms that operate the control are not known. Studies carried out at the Central Drug Research Institute, Lucknow, have shown that reticulocytosis could be induced in rabbits by the administration of phenylhydrazine. The reticulocytes obtained thus differ from mature RBC in their ability to concentrate and efflux amino acids. The patterns of enzymes mediating the intermediary metabolism of amino acids in the two types of cell are also different. Aspartate aminotransferase exists in two isomeric forms and the isomer present in reticulocyte has an electrophoretic mobility different from the one predominant in mature RBC. Glutamic dehydrogenase is located in both membranes and in the soluble fraction and regulates the intracellular pool of other amino acids.

The above work was carried out by Smt. K. Balasaraswathi (Lecturer in Biochemistry, Government Medical College, Kozhikode, Kerala) during the tenure of a CSIR research fellowship while on deputation at the Central Drug Research Institute, Lucknow. Smt. Balasaraswathi was awarded the Ph. D. degree by the University of Madras for her thesis relating to the studies.

Fatliquors from Frog Body

India exports about 2500 tonnes of frog legs annually, earning considerable foreign exchange. About 10 000 tonnes of frog body are thrown out as waste. It has been established that the body contains 4-5% of extractable oil, mostly in its fat glands. The Central Leather Research Institute (CLRI), Madras has further processed the oil and prepared an excellent fatliquor. The fatliquor developed has been found to be as good as neats-foot and sperm oil based fatliquors, which are being imported at present. The material from which the oil has been extracted could be used for the production of gelatine and animal feeds. The exploitation of this waste is expected to yield about 300 tonnes of oil from which about

400 tonnes of fatliquors can be processed. Since this is the first time that a very useful outlet has been suggested for this waste product, it is necessary that this oil is exclusively kept at the disposal of leather industry for the production of sophisticated leathers, mainly for export.

Development of Acid Bate

A bating agent with enzymatic activity under acid conditions has been developed by the Central Leather Research Institute (CLRI), Madras. It can be used on goat, sheep and calf skins for the manufacture of different types of leathers. The bating action of this product is comparable to that of conventional bates. Semi-commercial production of this product is being undertaken to evaluate its techno-economic feasibility.

Antibacterial Agent for Vegetable Tanning Material

An antifungal and antibacterial agent named Anbafung for use in vegetable tanning has been developed by the Central Leather Research Institute (CLRI), Madras. A mixture of chemicals, the product prevents mould and fungal growth in vegetable tannin liquors and leathers. It will find ready use in the production of various types of vegetable tan leathers. In addition, the use of this product helps in achieving a higher yield of leathers, prevents sludge formation to a considerable extent and also prevents the darkening of the vegetable tannin infusions due to ageing. The product is being tested on a large scale in a commercial concern.

PROGRESS REPORTS

CMERI Report : 1970-72

The report of the Central Mechanical Engineering Research Institute (CMERI), Durgapur for the period 1970-72, published recently, records projectwise the progress of research and development work in its seven major divisions, viz. Applied Mechanics; Applied Science; Automobile Engineering; Heat, Power and Refrigeration; Materials; Product Development and Industrial Design; and Production Engineering. Against the financial inputs of Rs 15.56 million the income of the institute during the period amounted to about Rs 1.06 million.

Photoelastic investigation of simply supported box type EOT crane girder was carried out as a result of which a box-beam of the specified shape with specific number of cut-outs in its side-web can be designed. At the instance of the Research Designs and Standards Organization, Lucknow, who are considering the choice of one of the types of cast steel wheel centres, viz. those with curved web as well as vertical web, for general adoption on the broad gauge (BG)

rolling stocks, investigations on three-dimensional photoelastic stress analysis of wheel centres for vertical and curved web profile of the BG rolling stock were carried out and stress analysis reports with recommendations were supplied.

A computer programme has been formulated in FORTRAN II language to calculate both volume and mean rate of flow of compressible or incompressible fluids at different operating conditions in accordance with BS-1042: code of flow measurement. The programme gives the data and results in tabular form in both British and metric units.

A 5-hp electromagnetic clutch for instantaneous coupling between load and the drive was designed and passed on to the G.R. Industries, Calcutta for commercial manufacture. The clutch finds extensive use in cotton and paper mills and is imported. A low-cost mechanical timer, working on watch mechanism, whose time can be set to operate an electric switch so that such electric appliances as television, radio, fan and lamp can be switched "on" or "off" at a specified time has been

developed. The timer has design flexibility of set time range and controlled load capacity. The first unit developed has a minimum set time of 15 min. and a maximum of 330 min. A circuit consisting of timing pulse and grating circuits has been developed as annex to the existing straight counter in order to count rpm and display the figure at every 2.5 s. A low-cost circuit has also been developed which controls the grates for obtaining rpm in digits.

A PZT crystal probe (1Mc/s) for use with Krautkramer type ultrasonic flow detector, USIP-10, has been designed and developed, and found satisfactory. Design drawings of a test specimen marking machine have been completed. This is used for graduating the gauge lengths and their divisions on tensile test specimens by two sets of punch marks along lines on the diametrically opposite sides of the specimen to facilitate the fixing of the extensometers as well as for physical measurements of the specimen for evaluation of elongations.

An important achievement concerned with agricultural machinery was the design and development of jungle jim, a tractor-drawn rotary type shredder used for chopping grass, bushes, crop stalks and weeds, and for cleaning the ground.

A portable lace/strap cutting machine has been designed for use in small scale industries. The machine is normally hand-operated but can be operated by power also. Materials like leather, skin, cloth, rubber, paper and cork can be cut with this machine. Design drawings of a handy indenting machine used for indenting various types of impressions on sole leather have been completed.

In collaboration with the Garden Reach Workshops (GRW), Calcutta, the institute has undertaken a project to design and develop a 10-hp power tiller suitable for wet land cultivation and for farmers with small land holdings. The designs of the power tiller engine with gear box and transmission system have been completed and a few

prototypes are being fabricated at GRW.

A portable oxy-gas cutting machine capable of cutting circular or straight ferrous materials of up to 4 in. thickness has been developed. Cutting by this machine is steady, dross-free and economic. A tungsten-inert gas (TIG) cutting torch and necessary ancillary equipment have been designed and developed. The prototype developed successfully cuts 25-mm thick steel and 40-mm thick aluminium plates.

Under a project sponsored by Guest Keen Williams Ltd, Howrah, the machinability of free cutting steel with different speeds and feeds normally used in shops was studied, and a relationship between the cutting speed and tool life was worked out.

A process for making the surface roughness comparison specimens has been developed. Made by a special electrolytic replica process the specimens are corrosion-resistant nickel reproductions and are identical in feel

and appearance with the master surface. The specimens provide an accurate, inexpensive reference standard that can be used for surface finish specification and control.

Know-how relating to the following four processes/products was released to industry through the National Research Development Corporation of India: 20-hp tractor (Swaraj); single lever automatic depth-cum-draft control hydraulic system; 5-hp electromagnetic clutch; and 100- and 200-hp hydraulic dynamometer. Know-how relating to the following 11 processes/products was ready for release: portable oxy-gas cutting machine; TIG cutting machine; semi-automatic submerged arc welding machine; manual arc welding electrode holder; crystal probe for ultrasonic testing machines; test specimen marking machine; indenting machine; lace/strap cutting machine; surface roughness comparison standards; height setting micrometer; and timer. Ten patents were accepted and 13 were filed during the period

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

NML PM-2 Aluminium Alloy : Versatile Electric Conductor

An aluminium conductor designated as NML PM-2 has been developed by National Metallurgical Laboratory (NML), Jamshedpur. The alloy has the following characteristics :

(1) Electrical conductivity greater than 61.5% IACS in thermomechanically treated condition, which is higher than that obtainable from EC grade aluminium; (2) Ductility as good as that of copper with adequate tensile strength; (3) Better corrosion resistance than EC grade metal; (4) Greater end product design freedom and capability; (5) Better quality of insulated cables in terms of surface finish; (6) Reduced power losses in transmission; (7) Greater productivity; and (8) Temperature stability up to about 180-200°C.

Tonnage quantities of this conductor material have been produced in associ-

ation with cable manufacturers. Its copper-like ductility enables it to be drawn into wires of fine sizes of up to 30 to 34 SWG. Its productivity is considerably greater than EC grade wires of equivalent diameters. Studies carried out in collaboration with the Hindustan Cables Ltd, Rupnarayanpur have shown that NML PM-2 conductor can substitute copper for many applications such as domestic and insulated cables, and underground telephone cables.

Although the superiority of NML PM-2 conductor has been proved for specific applications, the unique combination of its electrical and mechanical properties suggests that it can be advantageously used for applications where copper has already been substituted by EC grade aluminium. Specifically, NML PM-2 conductor is ideally suited for domestic wiring. Domestic cables produced from EC grade metal

are subjected to frequent failures and interruption of electric supply because of their relative brittleness. NML PM-2 conductor will be suitable for the purpose because it possesses higher ductility than annealed EC grade metal.

Besides for the production of underground telephone cables, NML PM-2 conductor can be used for the production of insulated cables and conductors, magnet wires, automobile cables, mining and trailing cables, harness wiring, flexible cords, welding cables, etc., where electric grade aluminium cannot be used owing to lack of suitable electrical conductivity, inferior strength and poor ductility.

Parties interested in the use of the technology of the NML PM-2 conductor may contact either the Director, National Metallurgical Laboratory, Jamshedpur 831007, or the Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Flexible Magnets

Flexible magnets are at present mainly used in refrigerator door gaskets. They also find application where cost is the main consideration and where low energy product can be tolerated. These magnets are not presently manufactured in the country, and hence their demand has not grown to the full extent. The estimated requirement if the product is made in the country is about 20 lakh feet of various widths, valued at about Rs 15 lakh.

The National Chemical Laboratory, Poona has developed a process for the production of flexible magnets. The process consists in hot rolling required quantities of binder and lubricant with continuous addition of ferrite till the mass becomes homogeneous. The lumps are pulverized and hot-extruded to the required dimensions. The strip is surface-magnetized to impart maximum attraction and holding power. The NCL process has been developed on 500 g per batch scale. Extrusion has been carried out in small pieces of

1-2 ft length. The product has the following specifications :

Ferrites-binder (polymer) ratio (by wt)	: 87 : 13
Remanance (BR)	: 1400 ± 50 gauss
Coercivity (HE)	: 1200 ± 50 oersted
BM (max)	: 0.40 MGO
Density	: 3.4 g/cm ³

The above properties as also flexibility, hardness and other physical properties match with those of the imported samples.

The raw materials required are barium-lead-strontium ferrite of 1-5 μ size, a suitable polymer, plasticizer, etc.

Hot rollers, extruder or press (high temp. 200°C), weighing machine (platform type, 0.1% accuracy), pulverizer, magnetizer and testing equipment are the important items of plant and machinery. All these are indigenously available, or can be fabricated in the country.

A unit capable of producing 10 lakh feet (1 cm width and 2 mm thickness) of magnets per annum has been taken as the economically viable capacity of the plant. The total capital outlay for a plant of this size has been estimated at Rs 5.81 lakh (Rs 3.90 lakh on building, plant and equipment, and Rs 1.91 lakh as working capital). The cost of production of the ferrites comes to about 50 paise per foot.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Menthol from Mint Oil

Menthol is a product in great demand by pharmaceutical and condiments industry. About 20 tonnes of menthol valued at Rs 60 lakh are presently consumed in the country. The consumption is likely to double in a few years.

A process has been developed for the production of menthol by the Regional Research Laboratory, Jammu, using mint oil (oil of *Mentha arvensis*) as the raw material. Confirmed by pilot plant tests, the process has

already been industrially worked in a factory in Jammu and can be demonstrated to potential entrepreneurs. The product conforms to the Indian Standard specifications.

Process : Crude mint oil is refined by vacuum filtration and is dementholized by repeated chilling and centrifuging. The menthol crystals are collected. The dementholized oil is subjected to saponification by sodium hydroxide and esterification by boric acid. Menthol separated as menthol borate is hydrolyzed and centrifuged to get liquid menthol which is repeatedly chilled and centrifuged to get menthol crystals. Liquid menthol is obtained as a byproduct.

The raw materials, viz. mint oil and chemicals, are indigenously available. The machinery, consisting mainly of distillation and reaction units, centrifuges and storage tanks, can be easily fabricated in the country.

A 10-kg per day plant is suggested, and this may need a total capital investment of about Rs 3 lakh. A sum of Rs 1.5 lakh may be required as working capital. The cost of production of menthol is Rs 160 per kg whereas the present market price is about Rs 300 per kg.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Citronellol from *Eucalyptus citriodora*

Citronellol is a high grade perfumery chemical used in soap and cosmetic industry. Presently this is produced from imported citronella oils at a cost of Rs 120-150 per kg.

The Regional Research Laboratory, Jammu, has developed a process for the production of citronellol using *Eucalyptus citriodora* oil as the raw material. The process consists in reduction of the oil after drying and further fractional distillation to get citronellol, hydrocarbons and residue.

Produced on a large bench scale, the product conforms to IS specifications : refractive index (20°C), 1.4568; density

(17°C), 0.8602; purity > 95%. Samples of the oil have been supplied to interested parties and have been well received.

The yield of citronellol is about 75% of the oil used. The raw materials required for manufacturing citronellol include *Eucalyptus citriodora* oil, isopropyl alcohol, aluminium propoxide or aluminium metal, mercuric chloride and carbon tetrachloride, commercial grade sulphuric acid and anhydrous sodium sulphate. All are available indigenously. The equipment required can be fabricated easily.

The capacity of an economically viable unit suggested by the laboratory is 10 kg per day (3 tonnes/year). The fixed capital for setting up a plant would be about Rs 1.57 lakh and the working capital, Rs 94 000. The estimated cost of production is Rs 108-110 per kg. A profitability of 20% is envisaged.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

CSIR SUPPORT TO RESEARCH

Completed Schemes

Physico-chemical Mechanisms Controlling Volume Change and Shear Behaviour of Clays

One of the most important concepts responsible for the contemporary development of soil mechanics is effective stress. This concept, enunciated by Terzaghi, has been the subject of extensive study in fully and partially saturated soils. It is now well known that clay particles carry overall negative charges and that the ratio of their surface area to mass is sufficiently high to influence the behaviour of particles and their aggregations. Hence, it is being increasingly recognized that the classical effective stress equation should be modified to the following form, with the consideration of the electrical attractive (A) and repulsive (R) forces, to

$$\bar{C} = \sigma - \bar{u}_w - \bar{u}_a - R + A$$

for the general case of a partially saturated soil, where \bar{C} is the effective contact stress, σ is the externally applied normal pressure, \bar{u}_w is the effective pore water pressure, and \bar{u}_a is the effective pore air pressure.

A study has been made to understand the physico-chemical mechanisms governing the diverse engineering behaviour of soils by the variations in attractive and repulsive forces (by the use of various organic pore fluids) and

those in pore water pressures (by changing the degree of saturation). The studies were made by Shri G. Venkappa Rao, a CSIR research fellow, who worked at the Department of Civil Engineering & Hydraulics, Indian Institute of Science, Bangalore. The mechanisms have been interpreted using the modified effective stress concept.

Kaolinite and montmorillonite clays were extensively used in the study, and limited use was made of three natural clay soils, viz. red earth, potter's clay and black cotton soil. Along with water and air, eight organic fluids, viz. hexane, heptane, carbon tetrachloride, benzene, ethyl acetate, ethyl alcohol and methyl alcohol, were used in the study to induce wide variations in electrical forces.

The strength behaviour of clays in the saturated state has been studied. Drained direct shear tests were conducted on saturated kaolinite and montmorillonite clays using the various organic fluids, the samples being prepared either by static compaction or by hand remoulding. The strength behaviour of both clays was found to be in conformity with the modified effective stress concept. The undrained strength relations of soils with changing degree of saturation were examined taking into consideration void ratio and soil type. The behaviour was found to

be consistent with the modified effective stress concept.

Two basic mechanisms concerning the volume change behaviour have been proposed. Volume change according to mechanism I is governed by the shearing resistance at interparticle level; and according to mechanism II, by the osmotic (double layer) repulsive forces. These mechanisms have been confirmed by conducting a series of one-dimensional consolidation tests using different organic pore fluids on kaolinite, montmorillonite and black cotton soil. Soaking tests, as well as tests with replacement of the remoulding pore fluid by another, were conducted to change the force system at interparticle level. On the basis of the tests, it has been concluded that although the proposed mechanisms operate simultaneously, mechanism I controls the volume changes primarily in non-expanding lattice type of clays and mechanism II, in the case of expansive clays.

Mechanisms controlling the compaction behaviour of kaolinite and montmorillonite have been examined using water and heptane as pore fluids. Although there are several factors which make the compaction behaviour complex, it has been possible to bring out that the two basic mechanisms, similar to those proposed for one-dimensional volume change behaviour, govern the compaction. Mechanism I, wherein the shearing resistance controls the behaviour, predominantly governs the dry density-moisture content relationships on the dry side of optimum, whereas mechanism II, in which the pore fluid pressure and double layer repulsive forces control the behaviour, primarily governs the behaviour on the wet side of optimum, irrespective of soil and fluid type.

The mechanisms involved in shrinkage phenomena have also been investigated. On the basis of a series of shrinkage limit tests conducted on kaolinite and montmorillonite, by using various pore fluids, it has been found that the modified effective stress concept successfully explains the role played by the capillary and electrical forces, soil

fabric and externally applied pressure during shrinkage. It is conclusively demonstrated that though surface tension forces are the cause of shrinkage, the void ratio at shrinkage limit is governed by the modified effective stress concept.

The mechanisms governing the liquid limit of kaolinite and montmorillonite have also been studied. Though it is widely accepted that liquid limit is a measure of the fluid content of soil when it approaches a particular shearing resistance, it is shown by conducting several tests with different organic pore fluids that the liquid limit of clays is controlled by the shearing resistance at particle level as well as the thickness of the diffuse double layer.

Precipitation and Reversion Studies in Aluminium Alloys

The phenomenon of precipitation hardening in some aluminium alloys based on both Indian commercial aluminium and super-pure aluminium with particular reference to the effect of impurities on the kinetics of the process has been investigated in detail by Dr K. G. Satyanarayana, a CSIR research fellow (now a UGC research fellow), who worked under the guidance of Prof. T. R. Anantharaman in the Department of Metallurgical Engineering, Banaras Hindu University, Varanasi. The object of the study was to understand the metastable equilibrium and reversion in Al-Zn (4-35 at. % Zn) and Al-Cu (0.75 and 1.5 at. % Cu). Techniques like X-ray diffraction, small-angle X-ray scattering and transmission electron microscopy were used.

An unexpected second hardness peak was observed on room temperature ageing of Al-Zn alloys based on Indian commercial aluminium. Such a peak does not occur in alloys based on super-pure aluminium, and its presence has been attributed to the major impurities, silicon and iron, present in the commercial aluminium. The results have been satisfactorily explained on the basis of differences in solute-vacancy binding energies. The magnitude of the second hardness peak

seems to depend on the binding energy of the third element (Si or Fe). Such an explanation has been verified by the addition of the other element (Mg) to Al-Zn alloys. The results of the earlier part of decomposition have been explained on the basis of 'spinodal decomposition', a special mode of decomposition in supersaturated solid solutions. The above concepts have also been extended to artificial ageing and reversion in all these alloys.

The reversion characteristics of the three ternary alloys, Al-Zn-Fe, Al-Zn-Si and Al-Zn-Mg, have been explained on the basis of spinodal decomposition in the early stage; later, a competitive mechanism between this and the discontinuous mode of decomposition operates. Magnesium does not seem to affect the reversion characteristics of Al-Zn alloys while Si and Fe do.

The solvus temperatures for G. P. zones and θ'' phase obtained for Al-0.75 (125-130°C and 166-172°C respectively) and 1.5 at. % Cu (168-173°C and 215-220°C respectively) alloys have been used to confirm and slightly modify the metastable solvus curves reported earlier.

The critical reversion temperatures for Al-4, 8 and 12 at. % Zn alloys (103, 168 and 182°C respectively) have been used along with all the earlier data to arrive at a new solvus for G. P. zones in these alloys. Following a critical study of the present and earlier lattice constant data for the transition (*R*) phase obtained through an accurate plot of lattice parameter vs zinc content (the plot is made in the present investigation using the least square method), metastable solvus curve for this transition phase in Al-Zn system has

been redrawn. Chemical and coherent spinodals have been calculated. Several modes of decomposition observed so far in this system have been critically discussed in the light of the present investigation.

A theoretical treatment of the X-ray diffraction effects in three dimensions observable in a spinodal decomposed Al-Zn alloy (appearance of 'sidebands') has been attempted for the first time. The evaluations are found to be in qualitative agreement with the experimental data.

The researcher was awarded the Ph. D. degree of BHU (1972) for his thesis based on the studies.

PATENTS ACCEPTED

Indian Pat. 129637

A process for the production of decolorizing type active carbon from coconut shell S. Banerjee, A. C. Dutta, S. Mojumdar, N. G. Basak & A. Lahiri
CFRI, Dhanbad

The process covered by the patent under reference is as follows :

Coconut shell dust of specified size below 16 B. S. mesh sieve (below 1 mm diam.) is mixed with a binder, such as starch solution (1-2%), at a slightly elevated temperature and briquettes of size $\frac{1}{2}$ to $\frac{3}{4}$ in. are prepared under low pressure (less than 5 lb/in²). For preparing briquettes other binders such as cellulose paste and rice bran may also be used. The briquettes so prepared are dried and carbonized in a static bed up to a temperature of about 800°C. The carbonized char is subjected to the action of preheated steam in a static bed at 850°-950°C for 1-1½ hr. After the completion of steam activation period active carbon is gradually cooled while steam flow through the

TABLE I — COMPARISON OF CFRI SAMPLE WITH BDH AND E. MERCK SAMPLES

	CFRI	BDH	E. Merck
Methylene blue adsorption, mg/g	160-180	190	192
Groundnut oil decolorization, %	50- 65	63	61.5
Molasses decolorization, %	88- 92	90.5	91.8
Water-soluble fraction, %	8- 10	9.8	9.7
Acid-soluble fraction, %	9- 10	8.8	9.4
Ash, %	5- 6	0.4	3.6
Moisture, %	1.1-1.5	—	—
pH	6-6.5	—	—

bed is allowed to continue till a temperature of 600° to 650°C is reached; the active carbon is then allowed to cool further to room temperature out of contact with air. The cooled product is treated with 1N HCl and water for adjusting pH.

A comparison of the properties of the CFRI product with those of BDH and E. Merck samples is given in Table 1 (p. 147). The ash content of the active carbon may be further reduced by thorough washing with HCl followed by water.

PATENTS FILED

1447/Cal/73 : A process for manufacture of silver-cadmium oxide compositions, D. Sen—NPL, New Delhi.

1479/Cal/73 : A process for the extraction and separation of strychnine and brucine from *Strychnos nux vomica*, C. Srinivasulu, S. R. S. Sastri, K. S. Narasimhan & S. N. Mahapatra—RRL, Bhubaneswar.

1480/Cal/73 : A process for manufacture of copper, copper alloys-graphite composite materials, D. Sen—NPL, New Delhi.

1481/Cal/73 : A machine for drilling holes in printed circuit boards, J. Singh & F. Singh—CEERI, Pilani.

1510/Cal/73 : Improvements in or relating to the process for removal of iron from ferruginous manganese ores, M. I. Ansari, B. R. Sant & G. S. Chowdhury—RRL, Bhubaneswar.

1542/Cal/73 : Gravimetric sampler for the respirable dust, R. N. Mukherjee, N. Gopalakrishnan & M. K. Chakraborty—CMRS, Dhanbad.

PATENTS SEALED

120705 : Improved thin film thickness monitor, S.P. Suri & V.V. Shah—NPL, New Delhi.

123209 : Synthetic filter aid for industrial filtration of water, P.N. Dadi-na & K. R. Bulusu—CPHERI, Nagpur.

123638 : Improvements in or relating to the production of cashewnut shell gum (CNS gum), T.R. Ingle, S.H. Vaidya & M. U. Pai—NCL, Poona.

123639 : A stable and water-soluble cationic resin from dicyandiamide suitable for use in leather, textile and paper industries, D. Mukherjee—CLRI, Madras.

123646 : A system for determining very small weights, N. Ramanathan & S. Ananthanaryanan—CLRI, Madras.

124215 : Improvements in or relating to electrolytic preparation of lead dioxide electrodes for electrolysis, H.V.K. Udupa, K.C. Narasimham & K.S.A. Gnanasekaran—CECRI, Karaikudi.

124509 : Production of oxalic acid from saw dust, S. B. Chaudhuri, M. Chakravarty & M. S. Iyengar—RRL, Jorhat.

124511 : Improvements in or relating to preparation of crosslinked polymers and derivatives thereof, B.D. Dasare, R. Ramaswamy, P.B. Trivedi & N. Krishnaswamy—CSMCRI, Bhavnagar.

124951 : A hydraulic prop incorporating a load indicating device, R.N. Gupta, B. Singh & K.N. Sinha—CMRS, Dhanbad.

125137 : A process for the production of protein concentrate from petroleum hydrocarbon fermentation broth, S.P. Srivastava, J.N. Baruah, H.D. Singh, P.V. Krishna & M.S. Iyengar—RRL, Jorhat.

125356 : A tubular type plant to separate water and other solvents from solution, A. S. Kane, D. J. Mehta & M.V. Chandorikar—CSMCRI, Bhavnagar.

125406 : Organic depolarizer batteries, P.B. Mathur, R. Balasubramanian & N. Muniyandi—CECRI, Karaikudi.

125548 : Manufacture of pig iron and similar products and stack furnace therefor, V. A. Altekar—NML, Jamshedpur.

125852 : An injected beam type crossed-field tube with improved Kino long gun, G.S. Sidhu & R.P. Wadhwa—CEERI, Pilani.

128471 : Improvements in or relating to the generation of square wave from sinusoidal wave, R. Mariadoss & M.S. Iyengar—RRL, Jorhat.

CRI Training Course in Concrete Technology

A training course in Concrete Technology will be organized by the Cement Research Institute of India, New Delhi and will be of 6 days' duration, starting from 26 November 1973. The course is aimed at equipping concrete engineers and technologists with the know-how for the production of 'good concrete' and acquainting them with the recent developments in the fields of concrete materials and concrete making techniques with particular reference to standardization and quality control.

The main topics to be covered in the course will include : concrete making materials; mix design; production, placing, compacting and curing of concrete; setting and hardening of concrete; strength, deformation and durability of concrete; special concretes; special processes; quality control and acceptance criteria covering statistical principles; workmanship; and testing and standardization.

Senior engineers and technologists concerned with construction, design and research in the field of concrete construction with a minimum qualification of a bachelor's degree in civil engineering or its equivalent are eligible for the course. The fee for the course is Rs 500 per participant. Registration is open till 1 November 1973.

Further details regarding the course may be obtained from : The Director, Cement Research Institute of India, M 10 South Extension II, Ring Road, New Delhi 110049.

Dr Panikkar Retires

Dr N. K. Panikkar, Director, National Institute of Oceanography, Panaji, handed over charge of his office, consequent on his retirement, on 16 August 1973 to Dr V. V. R. Varadachari, Head of the Physical Oceanography Division of the institute.



CFRI's Design of Beehive Coke Oven Wins NRDC's Highest Award

The new design of beehive coke oven developed by the Central Fuel Research Institute (CFRI), Dhanbad [CSIR News, 22 (1972), 115] has been chosen by the National Research Development Corporation of India (with which the Inventions Promotion Board has been merged) for the invention award of Rs 5000. The awards were announced by NRDC, on the eve of this year's Independence Day. The amount is the highest awarded by NRDC. Another invention, viz. transistorized gear box controller, was also chosen for the award of a similar amount.

A total sum of Rs 36 500 has been awarded this year for 28 meritorious inventions to 47 scientists, technologists, industrial workers, and other private inventors. In addition to these awards, financial assistance amounting to Rs 13 600 has been sanctioned for the development of 7 inventions.

The inventors of the new design of coke ovens are Sarvashri Kunda Singh, N. G. Banerjee, M. V. P. Menon and S. Bagchi and Dr A. Lahiri.

In conventional beehive ovens, the crushed coal charge of 4-5 tonnes takes about 72 hr for coking. Heat

required for carbonization is generated by combustion of volatiles released from coal in the space between the coal charge and the arch of the furnace. Carbonization starts from the top of the coal charge and proceeds downwards. Two factors, viz. lower thermal conductivity of coal and unidirectional heating, not only lead to prolonged carbonization time but to incomplete carbonization of the coal charge towards the bottom. Thus, a fair proportion of coke from the ovens, nearly a third, may have to be rejected from the category of metallurgical coke.



Improved Beehive Coke Ovens designed by CFRI-TISCO and installed at Sijua

Process

During studies on the operation of conventional beehive ovens it was observed that an appreciable amount of combustible material escapes with the hot flue gases through the chimney, leading to considerable heat losses. This potential heat along with the sensible heat of the hot flue gases was utilized for the coking process by a radical change in the design of beehive oven. A part of the volatile matter evolved is combusted on top of the coal charge, consistent with the heat requirement for carbonizing the upper part of the coal charge. The combustion gases are withdrawn through two downcomers located in the back wall of the oven and passed along the sole of the oven through an efficient design of the hair-pin flues where not only the sensible heat of the gases is utilized but the potential heat is recovered by admitting secondary air at appropriate points which burns the uncombusted gases to almost complete combustion. The flue gases after passing through the entire system of flues combine into a common stream at the base of the chimney through which these escape.

Novelty

The chief novelty of the design is that controlled supply of primary air is admitted at correct points above the coal charge for restricted combustion, consistent with the heat requirement for carbonizing the upper part of the coal charge and at the same time avoiding the combustion of coke. Twin off-takes are provided for even distribution of the hot gases together with the residual combustible gases in a system of flues in the sole of the oven where additional incremental requirement of secondary air is admitted for combusting residual combustible gases. The combustion gases are distributed in such a manner that the contact time with the sole is maximized by using hair-pin flues of adequate dimensions, and distributed in two separate streams before joining for off-take through the chimney. Provision has also been made in the

design to enable control of temperature in each of the ovens by control of draught and control of primary and secondary air required for combustion. The secondary air supply is so designed as to enable preheating before admission to the sole flues.

Additional improvements have been made in the design of the oven to increase its structural strength, to provide easier levelling and for ensuring greater uniformity of the coal charge and for bypassing the sole flues during coal charging and for starting up. Adequate arrangements have been made for cleaning the sole flues as and when required. The complete combustion of the flue gas prevents carbon deposition in the flue and enhances heat transmission.

Because of the faster rate of coking achievable in these ovens, blends containing a substantial proportion of substandard coking coals can be carbonized to produce hard coke suitable for metallurgical purposes. Standard fire bricks and refractory tiles are used in the construction of these ovens. No shaped refractories are necessary, hence the oven cost is low. The ovens can be constructed entirely from indigenous materials. Their operation does not involve the services of personnel of high technical training. For a given coke output, the capital investment is about 40% lower as compared to that for conventional beehive ovens.

Commercial scale tests

Tests carried out in a commercial battery of ovens constructed according to this design have shown that :

(1) Carbonization time is 26 hr 45 min in continuous operation, which could be reduced further if superior quality bricks are used for the construction of the oven. Carbonization time in conventional beehive ovens is 72 hr.

(2) The yield of coke is considerably higher than in conventional beehive ovens.

(3) Coke of inferior grades and loss of coke due to combustion are reduced to the minimum.

(4) The quality of coke is comparable, if not superior, to that produced in byproduct ovens.

Commercialization

Tata Iron and Steel Co. has installed at Sijua, Dhanbad, 352 ovens of the improved design with a total coal carbonizing capacity of about 4 lakh tonnes per annum. This plant is in operation.

The National Coal Development Corporation Ltd has finalized a project for the installation of 100 such ovens at Sawang for carbonizing about 1.2 lakh tonnes of coal per annum.

Several other small-scale industries are negotiating for installing ovens of this design.

The Inventors

Brief biographies of the inventors of the non-byproduct recovery coke ovens follow.

Shri Kunda Singh

After graduating from the Delhi University in 1955, Shri Singh joined CFRI in 1956. Attached to the pilot plant division of the institute, he has worked in the high and low temperature carbonization pilot plants and formed coke pilot plant. His researches relate to the selection of coking blends for various steel plants and other commercial coke ovens and to improving the quality of coke produced from different blends. He has taken active part in the heating up and commissioning of three batteries of commercial coke ovens and has conducted guarantee tests of a battery of byproduct ovens.

Shri Singh was a member of several study teams sent by CFRI for assisting commercial coke oven plants to solve operational problems which include (i) 'roof carbon' trouble in the coke oven of Durgapur Projects (1966); (ii) lower production of ammonium sulphate from the coke ovens and byproduct plant of the Durgapur Steel Plant (1968); (iii) lower yield of byproduct from the Bararee coke ovens and byproduct plant at Kusunda (1970); (iv) thickening of tar produced from the coke oven of Bhilai Steel Plant (1972)



Shri Kunda Singh



Shri N. G. Banerjee



Shri M. V. P. Menon



Shri S. Bagchi



Dr A. Lahiri

(v) lower yield and poor quality of coke from the beehive ovens at Bhulan Bararee (Jharia coalfield), Namdung (Assam), Kharkharee (Jharia field), West Victoria (Raniganj field), and Amlabad (Jharia field). He was also associated with the coking tests carried out in the commercial coke ovens of TISCO.

In June 1970 Shri Singh was deputed to Poland for five weeks under the Exchange of Scientists Programme and acquainted himself with the researches conducted there in coal carbonization and production of formed coke. In 1972 he took a leading part in designing the improved beehive oven and evaluating the performance of such type of ovens installed at Sijua.

Shri Singh passed the Fuel Technology examination (advanced grade) in 1964, was elected Associate Member of the Institute of Fuel (London) in 1965 and passed the A. M. I. E. (India) examination in 1973.

Shri Singh is a recipient of the tenth National Metallurgists' Day award in 1972 for his outstanding contribution to fuel technology.

Shri N. G. Banerjee

After graduating with honours in chemistry in 1940 from the Calcutta University, Shri N. G. Banerjee started his research career under the auspices of the Fuel Research Committee in 1944. His studies were concerned with the properties of coal from various coalfields of India and blending potentialities of semi-coking and weakly caking coals for metallurgical coke production.

Joining CFRI in 1949, Shri Banerjee developed a number of new and refined methods of determination of carbon, hydrogen, sulphur, nitrogen, chlorine, moisture, etc. in coal, coke, and coal-tar products. Studying the phenomenon of spontaneous combustion of coals, he formulated a method of classification of coals with respect to their spontaneous ignition characteristics. He has published several papers on the complexometric methods of determination of the constituents of coal ash and on the nature and characteristics of mineral matter in South Arcot lignite and in the coals of many coalfields. He extended his research to the utilization of indigenous variety of asbestos for the production of asbestos cement.

In 1958 Shri Banerjee was posted as Officer-in-charge of the Raniganj Coal Survey Laboratory and in 1961 as Officer-in-charge of the Bilaspur Coal Survey Laboratory. Since 1963 he has been in charge of the high temperature carbonization pilot plant. He has studied the coking and blending characteristics of a number of Indian and foreign coals.

Shri Banerjee has assisted the Indian Standards Institution in the formulation of standard methods of analysis of coals and coke. He is a member of the Institution of Chemists (India) and Coke Oven Managers' Association (UK). He visited France and West Germany in 1964 as a member of the three-member delegation which studied stamp-charging and selective crushing techniques for coal carbonization. In 1966 he went to Poland where he stu-

died coal carbonization and briquetting technologies.

Shri Banerjee has extensively studied the design and operation of the beehive ovens in operation in the country. Author of more than 55 research and review papers, he has to his credit six patents jointly with his colleagues and has collaborated in the preparation of 50 investigational reports. He is co-author of the CFRI monograph on Coal Carbonization.

Shri M. V. P. Menon

Shri M. V. P. Menon joined CFRI in 1954, after graduation from the Madras University. As a Scientific Assistant he worked extensively on sampling, analysis and testing of coal, coke tar and other byproducts from carbonization of coal. He has also contributed in considerable measure to the development of laboratory methods of evaluating the coking properties of coals. He was transferred to the high temperature carbonization pilot plant of the institute in 1957. He has considerable experience in the heating up and operation of different coal carbonization plants and has taken part in the guarantee tests of coke ovens at FCI (Sindri unit) and at Durgapur. Since 1963, when he was promoted as Scientist, Shri Menon has been engaged in investigations and research on the coking and blending characteristics of Indian and foreign coals, selective preparation, stamping, and effect of different carbonizing conditions and additives, and has been responsible for planning and executing test programmes in connection with

the selection of suitable blends for steel plants and merchant coke ovens. He was also a member of the teams undertaking investigational work into operational troubles in byproduct coke ovens at Bhilai, Durgapur and Kusunda and in various beehive oven plants at Bhulan Bararee (Jharia), Kharkharee (Jharia), Amlabad (Jharia), Namdung (Assam) and West Victoria (Raniganj).

Shri Menon has played a significant part in evolving the design of improved beehive ovens. He is joint author of about 20 papers and has been associated with the preparation of a large number of technical reports. One of his papers entitled 'A study of the vertical shrinkage of coal on carbonization', in joint authorship, was awarded silver medal in 1964 by the Coke Oven Managers' Association, UK. He is a member of the Indian Institute of Chemical Engineers.

Shri Menon received the National Metallurgists' Day award of 1972 in recognition of his outstanding contribution to fuel technology.

Shri S. Bagchi

Shri S. Bagchi is now Director, Central Mining Research Station, Dhanbad. Shri Bagchi's biography has been published recently in *CSIR News* [23 (1973), 125].

Dr A. Lahiri

After a brilliant academic career at the Calcutta University from where he obtained M. Sc. (geology) in 1938, Dr Lahiri proceeded to UK and obtained Ph. D. (geochemistry) from the London University in 1941 and D.I.C. from the Imperial College of Science & Technology, London, in 1942.

Dr Lahiri started his career as a Research Assistant in the Imperial College of Science & Technology in 1942. Later, he joined the Fuel & Oil Research Station of the Royal Aircraft Establishment, Farnborough, as Scientific Officer, where he became the Head of the Division subsequently.

Dr Lahiri was appointed Assistant Director (planning) of CFRI in 1945,

became Deputy Director in 1953 and Director in 1954.

Dr Lahiri's contributions in the field of fuel utilization technology relate to: introduction of commercial coal beneficiation schemes in India; blending and carbonization of substandard coals for metallurgical coke-making; generation of power from high-ash pulverized coal; planning of coking coal conservation; planning of long-distance gas distribution; formulation of a national energy scheme; devising methods for using non-coking coals in iron-making; formulation of a national energy policy; and standardization of petroleum and coal based products, methods and equipments.

Dr Lahiri has also been associated with the planning of a number of integrated industrial complexes such as at Durgapur, Neyveli (Tamil Nadu), Talcher (Orissa), and Ramgarh (Bihar), some of which have already been established. He has prepared project reports on conversion of Assam coal to oil, and resources development studies for Uttar Pradesh, Madhya Pradesh and Bihar. His report on 'Problems of Coking Coal in India' provided considerable technical assistance to the Government of India in its decision to nationalize coking coal mines and their subsequent reorganization.

Dr Lahiri has published nearly 500 research and review articles and has co-authored 83 patents.

Dr Lahiri is recipient of the Presidential Award *Padma Bhushan* in 1969. [See also *CSIR News*, 19 (1969) 27].

Acoustical Studies in School Buildings

Under the sponsorship of Unesco and the Asian Regional Institute for School Building Research, Colombo, the Central Building Research Institute, Roorkee, carried out a study on the diffraction of sound around flexible partitions usable in teaching spaces. It was a comprehensive study of the acoustical conditions in several school buildings in Sri Lanka, India, Malaysia and Singapore, involving the measurement of noise reductions by some

typical flexible partitions. The current trend is to use these partitions for dividing teaching spaces. Conclusions in regard to such important factors as the height of the partition between two teaching spaces, the material of partition, and the position of chalk-board, were arrived at. Noise levels, which primarily decide the acoustical conditions, obtaining in class-rooms of different countries were measured. The study led to the following conclusions:

- (1) No child should be more than 7 m away from the teacher.
- (2) Flexible partitions should have a noise reduction of at least 5 db.
- (3) Partition height should be 2 m when teachers are back to back and 2.4 m when they are on opposite ends.
- (4) Noise levels in class-rooms should not exceed 60 db.

Role of Magnesium in Bioenergetics

Magnesium deficiency *per se* is a rare condition in man; nonetheless certain nervous disorders and tetany occur in children suffering from dietary multi-deficiencies including those of minerals. Such a condition can also occur in children who receive transfusion of citrated whole blood or blood plasma. Magnesium is known to take part in innumerable enzymic reactions but its precise role in cellular energetics and protein synthesis has not been elucidated. Studies on the role of magnesium in bioenergetics have been carried out by Smt. Shanta Sharma, (Biochemist, Pediatrics Department, K. G. Medical College, Lucknow) during her tenure as a CSIR research fellow at the Central Drug Research Institute, Lucknow.

Magnesium deficiency could be induced in rat weanlings by giving a diet of low magnesium content. The animals showed typical symptoms of hyperemia, irritability and altered electrocardiographic patterns. In such animals oxidative phosphorylation of mitochondrial fractions prepared from heart, skeletal muscle, brain, liver and kidney was inhibited. The mitochon-

dria also showed altered response to swelling agents, suggesting that they have become more permeable. The animals also showed reduced capacity to incorporate ^{14}C -labelled amino acids into tissue proteins. All these defects were corrected when the deficient animals receiving the magnesium-

low diet were given supplements of magnesium in the diet. The results suggest that when the diet is low in magnesium the element is not presumably integrated into the membranes of tissues as a result of which structural disturbances leading to inhibited functional activity manifest themselves.

PROGRESS REPORTS

NPL Annual Report: 1970-71

The annual report of the National Physical Laboratory (NPL), New Delhi for 1970-71, published recently, records the progress of R & D activities under the following six areas: Standards; Testing & calibration; Applied research and developmental work; Glass technology; Oriented basic research; and Radio science. The 70-page report (royal 8vo) shows that the laboratory was reorganized into eight groups: Standards and testing; Test and evaluation (centre), electricity and electronics; Specialized techniques; Materials and carbon; Developmental projects; Oriented basic research; Radio science; and Pilot plants.

Efforts were continued to improve the accuracy of primary standards of length, mass, time, electric current, temperature and luminous intensity as well as of derived standards of electric resistance, emf, power, force, atmospheric pressure and sound pressure being maintained by the laboratory. An absolute radiometer which would serve as a standard of irradiance measurement has been designed and is being fabricated. Standards for capacitance, electrical energy and spectral radiance are being established.

Being the custodian of national standards, NPL undertakes testing and calibration work in various spheres of industrial activity, and testing work comprises: (i) testing and calibration against SI system of units and against standard specifications laid down by ISI, and other standard specifications; (ii) life and environmental tests; and (iii) tests on the purity and perfection of materials. The laboratory tested a wide variety of industrial products,

measuring instruments, prototypes, etc. and issued 2724 certificates/reports; revenues from tests amounted to about Rs 2 lakh. A test and evaluation centre for life and environmental testing of electronic components, equipments, etc. under tropical conditions is being set up to cater to the needs of the industry in the northern region.

An important applied research project of the laboratory is concerned with the development of metrological and diffraction gratings. A linear machine for making gratings of 20 and 40 lines/mm for strain analysis has been designed and fabricated. Work on the design of a circular machine for producing circular gratings and the crossing jig for making orthogonal and triangular gratings is under way. A Lang camera for recording section topographs has been designed and fabricated, and section topographs of silicon, lithium fluoride, potassium bromide and sodium chloride have been successfully recorded in transmission and reflection.

The technology of fabricating various types of cathode ray tubes and TV picture tubes has been developed. The various processing steps, viz. deposition of phosphor inside the glass bulb, aquadag coating, aluminizing of the bulb, electron gun fabrication, sealing of the gun to the bulb, evacuation, processing and testing have been perfected. Techniques have also been perfected for reconditioning these tubes. The phosphor used for cathode ray tubes and TV picture tubes has been developed indigenously.

As part of the long-range programme of the development of digital and logic circuitry, the laboratory took up a project on the development of elect-

ronic desk calculators which are presently imported. In the first phase of the project, work on six-digit two-function (addition and subtraction) calculator was undertaken with emphasis on maximum use of indigenous components, and a prototype was fabricated using indigenous discrete components. The machine enables computation in any arbitrary manner. These electronic calculators can not only be produced on a large scale at lower cost but also operate more quickly and far more quietly, and are easier to use than their electrical counterparts.

A prototype of 0.5 to 1 mW helium-neon laser was developed and some units were supplied to universities. Pulsed argon-ion lasers (lasing at wavelengths 5145, 4965, 4880 and 4765Å) have been developed. A comprehensive shear interferometer for testing optical systems has been developed in which one interfering beam is compressed and the other expanded and then the two are recombined. The special features of the interferometer are that the amount of compression is variable and that compression can be given in both the meridians (radial compression) or in one meridian (linear compression). With radial compression the interferometer is suitable for the measurement of aberrations of cameras and similar objectives, whereas with linear compression it is used for the measurement of resolution of photographic emulsions. A simple, unequal-path inverting interferometer for precision alignment with the laser has also been developed and is under trial.

A low-pressure air liquefier, based on Claude cycle, of a capacity of 8 litres of liquid air per hour has been designed and various components have been fabricated.

Polycrystalline silicon was produced using silicon tetraiodide cracking method. Single crystals of silicon (10-11 mm diam.) were prepared by float zone technique. The technique of casting thin silicon rods of 3-4 mm diam. for use in cracking silicon on silicon was developed.

Ferrites with permeability in the range of 1500 to 3000 have been

developed by sintering manganese-zinc ferrites under controlled atmospheric conditions. Dies and tools for making complicated shapes of pot cores, E-cores and U-cores for EHT transformers have been designed and fabricated. Memory cores (50-80 mils) conforming to the international standard specifications have been developed and found satisfactory. A thermoplastic process for the production of ferrites of complicated shapes has been developed; the process consists in mixing raw ferrite powder with a plastic binder and then moulding the mixture into desired shape at ordinary temperatures.

Projects of fundamental nature investigated by the laboratory were concerned with: Mössbauer studies on ferrites, ferroelectrics and anti-ferroelectrics, localized \Rightarrow collective electron transition and Brownian motion, Josephson radiation for establishing voltage standard, and transport properties in dilute magnetic alloys.

Investigations in aeronomy, ionospheric physics, and solar-terrestrial relationships have yielded significant results. Under a PL-480 scheme, studies were carried on D and F region effects during normal and flare times with frequency deviations, phase anomalies and LF/VLF amplitude change.

A riometer with a beam of 10° at 40 MHz has been designed and fabricated to study the absorption at oblique incidence. A payload was successfully launched atop a petrol rocket from Esrange, Kiruna (Sweden).

Know-how relating to the following seven processes/products was released to industry: cinema arc carbons; electrostatic photocopying machine; film thickness monitor and controller; ultrasonic interferometer for velocity measurements in liquids; linear drive for Mössbauer spectrometer; microwave components (C/XN band); and broadband ferrite isolators for microwave applications.

A patent relating to the process for making a print of a document with the electrostatic photocopying machine was filed. Forty-four research papers were published during the year.

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

Sulphited Oil Fatliquors based on Sardine Fish Oil or Shark Liver Oil

When sardine fish oil or shark liver oil is sulphited with sodium bisulphite, the resultant product is a viscous brown oil. This oil easily emulsifies well in hot or cold water and is more stable to acids and salts than sulphated oils. The Central Leather Research Institute, Madras has developed a process for the manufacture of sulphited fatliquors based on sardine fish oil or shark liver oil.

Leathers fatliquored with these oils either alone or in blends with other oils are quite soft, supple, have full handle and give tighter grain. Because it is stable, the oil can be added in the tanning bath both before and after tanning. The oils have several applications: they are suitable for vegetable tanned, chrome retanned upper leathers, wetting and light leathers. The only exceptions are white and pastel shade light leathers.

At present only sulphated oils are being used for fatliquoring and these do not give satisfactory quality leathers. Sulphited oils give rise to better quality leathers but these oils are presently imported. The sulphited fatliquors based on sardine oil/shark liver oil would be a big fillip to the leather industry.

The raw materials required are sardine fish oil or shark liver oil, and sodium bisulphite, and both are available indigenously.

The equipment required for the process include steam-heated stainless steel reaction vessel with arrangements for stirring, blowing air, temperature control, and necessary fittings; air blower; boiler; storage tanks for raw materials and finished products; and pumps.

The minimum economically viable plant size suggested by CLRI is 15 tonnes per annum. The total capital investment on the plant is estimated

at Rs 1.40 lakh. The cost of products from sardine fish oil is estimated at Rs 6 to 6.50 per kg and that of products from shark liver oil at Rs 7 to 7.50 per kg.

The process has been tested on a pilot plant of 60 kg per batch capacity. Consumer acceptability trials have testified to the satisfactory quality of the product.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Tape Recorder (two-track, monophonic)

Tape recorders play an important role in entertainment, education and instrumentation. A good quality half-track tape recorder has been designed and developed by the Central Electronics Engineering Research Institute, Pilani. It is simple in design and makes maximum use of indigenous materials and components. The electronic circuitry uses indigenously manufactured silicon transistors and components. A number of interlocking arrangements have been incorporated in the design to prevent wrong operation of controls.

Specifications of the tape recorder developed by CEERI are as follows:

Tape speed	: 19 and 9.5 cm/s
Frequency response	: 50 Hz to 12 kHz (19 cm/s) $(\pm 2.5 \text{ db})$
Wow and flutter	: 0.15%
Equalization	: 100 μs for tape speed 19 cm/s 200 μs for tape speed 9.5 cm/s
Power output	: 1.5 W

The tape transport mechanism ensures that the tape moves past the record and playback heads at a constant speed. The motor is directly coupled to the platforms on which the spools rest, and interlocking arrangements have been incorporated to pre-

vent the fast drives from being activated during play. The electronic circuitry is divided into three portions, viz. oscillator, record amplifier and playback amplifier.

A few units have been batch-produced at the institute and exhaustive tests have been carried out. The tape recorder can give a frequency response up to 12 kHz or more and conforms to the CCIR and IEC specifications.

All the raw materials, except the motor, indicating meter, number counter and erase heads, are available indigenously.

The minimum capacity of an economically viable unit for the production of tape recorders is 12 000 units per annum. The total capital outlay for a plant of this size has been estimated at Rs 25 lakh (Rs 6 lakh on building and Rs 17 lakh as working capital). The cost of production has been estimated at Rs 550 to 600 per unit.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

PATENTS ACCEPTED

Indian Pat. 129724

Improvements in or relating to a method for the extraction of nickel from lateritic nickel ores

P. K. Rao & B. R. Sant

RRL, Bhubaneswar

The process covered by the patent concerns the selective extraction of nickel from the lateritic nickel ores of Orissa containing small amounts of nickel (and cobalt) and substantially larger amounts of iron and/or silica and magnesia. Typical analysis of the ore is as follows: nickel 1.2%, iron 46%, silica 9.5%, chromium 0.6%, magnesium 0.3%, manganese 0.7%, aluminium 1.9%, and loss on ignition 15.8%. The ore is mixed with a suitable amount of hydrochloric acid, dried at 60-120°C and the resulting mass roasted at 200-400°C. The principle of the method is that nickel oxide can be converted to water-soluble nickel chloride whereas ferric oxide cannot be converted to water-soluble products. The roasted

mass is leached with hot water to bring nickel values into solution. The leach liquor needs purification to finally obtain pure nickel powder or salt.

Optimum conditions have been worked out for extracting nickel from the lateritic nickel ores of Orissa. About 90% of nickel is selectively leached into solution with minor amounts of iron. The cobalt associated with the nickel of the ore has also been similarly extracted into solution.

Indian Pat. 130123

Battery system incorporating tin anode

P.B. Mathur & N. Venkatakrishnan

CECRI, Karaikudi

Zinc, magnesium, aluminium, lead, iron and cadmium have been commonly used so far as anode element in primary and secondary batteries. This patent refers to the use of tin metal as anode element in conjunction with silver oxide and other metal oxide cathodes which operate in alkaline solution. The tin-silver oxide cells have been found to possess the minimum time of activation (0.2 s) and so the system appears to be highly promising as a single-shot battery for missiles. The battery system has a long shelf-life in un-activated state, operates at 1.45-1.00 V, and is capable of discharging at 3A/in² at an operating voltage of 0.925 V. Its ampere-hour efficiency varies from 95 to 65% between room temperature and -20°C. Only indigenous equipment and machinery are required for fabricating the battery.

Indian Pat. 131021

A process for removing oxide coating from zinc dust powder by a chemical method

G. Basak, V. S. Sampath & R. P. Bhatnagar
NML, Jamshedpur

During the production of zinc dust and on its long storage, fine particles of metallic zinc tend to get corroded, and the metallic contents fall below the specifications for application in chemical and other allied industries.

Generally, the oxidized powder is discarded as a waste. However, zinc values could be utilized by subjecting them to dissolution in acid for recovery of zinc in the form of zinc com-

pounds, or the zinc dust may be further oxidized to obtain zinc oxides. These methods are not economical. The process covered by the patent selectively dissolves the products of corrosion on the zinc particles leaving behind the metallic portion. This ensures the recovery of the zinc values in the form of reusable zinc dust.

The process is very simple and consists of (i) pickling the oxidized zinc dust with a solution of ammonium salt and ammonium hydroxide mixed in suitable proportions, (ii) filtering, and (iii) drying.

Indian Pat. 131257

A process for the preparation from spent chandrus of a French polish that gives a hard and glossy finish to surfaces of wooden furniture that have received a ground-coat of shellac polish

J. G. Srivastava

NBG, Lucknow

During the preparation of Canada balsam substitute from the crude natural product 'chandrus' (*Shorea weisneri* Schiffn.) the harder resins (67% by weight of the whole) are left behind unaffected by the solvents used. This is the spent chandrus for which there was no use till recently.

A methylated spirit solution of whole 'chandrus' is quick-drying and gives a hard and glossy finish to surfaces of wooden furniture that have received a ground-coat of shellac polish. A solution of 'spent chandrus' in methylated spirit does not give a satisfactory finish, and up till now no processes are known for getting a satisfactory finish from this material in any other solvent or solvents.

The process covered by the patent under reference consists of refluxing 'spent chandrus' in a mixture of cheap and easily available solvents to give a clear and colourless solution that can be used as such or after dilution to give a hard and glossy finish at a very little cost. This French polish dissolves out fat and grease spots so that it can be applied even on dirty surfaces. Also, as oil-soluble aniline dyes can be incorporated in the solution, the processes of staining the surface and of

giving it a finish can be performed simultaneously.

The manufacture of the French polish by this process can be an ancillary industry attached to the unit for manufacturing Canada balsam substitutes or to a paints and varnishes factory.

Indian Pat. 131636

Improvements in or relating to electrochemical marking on silver

S. I. Krishnamoorthy (SSTC, Trivandrum) & S. Guruswamy
CECRI, Karaikudi.

Electrochemical marking has assumed importance during the last two or three decades as a convenient method of marking metal articles of industry and commerce for the purposes of identification, certification of quality, and advertisement. The method has the advantages of speed, clarity, performance, ease of production and least damage to underlying metals. Earlier Indian patents [118016 & 118256] of these patentees deal with the design of an electroholder and the combination of electrolytes required for etching over a wide variety of metals based on the anodes etching by chloride ions. These electrolyte systems are not suitable for silver, as silver chloride is insoluble. In this patent, a suitable electrolyte combination has been described which is based on the anode etching property of nitrate ion of silver, and the control of the solubility of silver chromate with the use of ammonium hydroxide.

Indian Pat. 131685

An improved method relating to extraction of nickel and cobalt values from oxidized (lateritic) ores

C. Sankaran, M. S. Mahanty & V. A. Altekari
NML, Jamshedpur

This invention relates to a process for the extraction of nickel and cobalt from oxidized ores and/or concentrates.

Conventional processes for the treatment of such ores include either roast reduction at elevated temperatures followed by ammoniacal leaching for the recovery of nickel and cobalt, or high-temperature high-pressure diges-

tion with sulphuric acid followed by recovery of nickel and cobalt as sulphides to be subsequently processed. These processes for the treatment of oxide ores have several disadvantages, viz. low recoveries, high capital and operating costs and use of a large number of unit operations involving high temperatures, high pressures, costly reagents, etc.

The patented process eliminates complex treatments like high-temperature roast reduction, and leaching with costly reagents, and consists in the roasting of the laterites with ammonium chloride at relatively low temperatures (190°-500°C) for a shorter time followed by leaching of the soluble chlorides of nickel and cobalt formed during the roasting operation with water. The nickel and cobalt can be suitably recovered from the chloride solutions by any of the conventional methods. The process is simpler in operation—fewer unit operations are required—and is capable of high recoveries of both nickel and cobalt. The reagent used during the roasting can be recovered and recycled at a convenient stage in the process.

PATENTS FILED

1571/Cal/73 : A process for the manufacture of ceramic bimorphs, V. N. Bindal, C. V. Ganapathy, T. R. K. Menon & N. Narayana Swami—NPL, New Delhi.

1600/Cal/73 : Improvements in or relating to measurements of light penetration in water, S. P. Anand—NIO, Panaji.

1601/Cal/73 : Preparation of unsymmetrical dimethylhydrazine by electrolytic reduction of N-nitrosodimethylamine, H. V. K. Udupa, K. S. Udupa, P. Subbiah & P. Thirunavukarasu—CECRI, Karaikudi.

1653/Cal/73 : Improvements in or relating to centrifugal irrigation pump, C. L. Garg—MERADO, Ludhiana (CMERI, Durgapur).

1690/Cal/73 : Improvements in or relating to spindle crowns for high speed spinning, K. Sreenivasan, K. V.

P. R. Pillay & S. N. Govindarajan—SITRA, Coimbatore.

1712/Cal/73 : Development of process for the utilization of corn stalk for making paper pulp, S. K. Bhowmik, K. Ghosh, S. Mahapatra & P. K. Jena—RRL, Bhubaneswar.

1713/Cal/73 : Angle probes for ultrasonic flaw detectors, V. N. Bindal & V. Gogia—NPL, New Delhi.

1759/Cal/73 : Improvements in or relating to a current controlled inductive transducer and associated electronic circuit used in the measurement of displacement and force, P. E. Sankaranarayanan—NIO, Panaji.

1760/Cal/73 : A method of diffusion welding stainless steel to mild steel in air, G. J. Guru Raja & N. D. Das—CMERI, Durgapur.

1774/Cal/73 : A process for the production of self-fluxing pre-reduced ore briquettes with non-caking coal chars, coke fines and fluxes, R. S. Ghosh, N. G. De, J. Singh & A. Lahiri—CFRI, Dhanbad.

Symposium on Oils & Fats, Surface Coatings, and Bleaching Earths & Active Carbons

A symposium on Problems and Prospects in Oils & Fats, Surface Coatings and Bleaching Earths & Active Carbons will be held at the Regional Research Laboratory, Hyderabad on 9 & 10 February 1974. The symposium, being organized by the Oil Technologists' Association of India at its 29th annual convention, will cover discussions on: (i) augmentation and better utilization of oils and fats; (ii) recent advances in surface coatings; (iii) bleaching earths and active carbons; and (iv) panel discussions on collaborative research between research institutes, universities and industries in the next five years. In addition, one session will be devoted to the presentation of research papers in oils and fats and related fields.

Further particulars can be had from: Dr A. J. Pantulu, Convener, OTAI Symposium, Regional Research Laboratory, Hyderabad 500009.



CSIR NEWS

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Mineral Processing and Pyro- & Hydrometallurgical Laboratories of RRL, Bhubaneswar Inaugurated

At a function held on 10 September 1973 at the Regional Research Laboratory (RRL), Bhubaneswar, Shri B. D. Jatti, Governor of Orissa, inaugurated the new Mineral Processing and Pyro- & Hydrometallurgical Laboratories. Research and development work on minerals and metals has been one of the major activities of RRL, and the addition of these two new laboratories is a step forward in the fulfilment of the objectives of this Regional Research Laboratory, the Governor said. He appreciated the laboratory's new programme of its scientists visiting the different districts of the state, creating the right type of entrepreneurship, modernizing the existing industries, and rendering technical aid in the setting up of various types of cottage, small- and medium-scale industries. He urged the industrialists, state government officials and entrepreneurs to take advantage of this new facility and extend their full cooperation and help in the successful implementation of the industrialization programme at the district level. Shri Jatti assured all cooperation by the Government of Orissa for the rapid development of this laboratory.

Prof. P. K. Jena, the Director, in his welcome address gave a resume of the research activities of the laboratory. He also mentioned that keeping in view the vast mineral resources of the region, the research activities in the areas of minerals and metals have been reorganized.

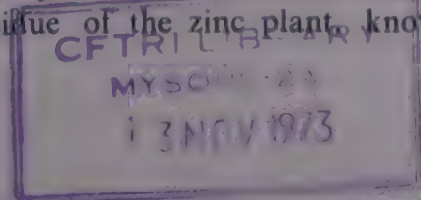
In the field of minerals and metals the activities of the laboratory aim at providing know-how for the utilization of the vast and varied mineral resources through beneficiation of low-grade ores and minerals, agglomeration of ore fines and production of ferrous and non-ferrous metals and alloys and cermets. As part of this programme the laboratory has successfully developed a new flotation column for the beneficiation of natural graphite to produce 96% pure graphite which has been further purified to more than 99% purity for making specialized graphite products capable of special applications. Owing to the shortage of magnesite in the country studies on the beneficiation of magnesites have been carried out, and a sample of magnesite supplied by a local industry has been beneficiated to a product acceptable to refractory industry. The laboratory has developed a process for cold pelletization of the huge quantities of friable chrome ore and chrome ore fines available in the region.

The laboratory is engaged in the beneficiation of low-grade manganese ores. Recently, a hydrometallurgical process for the removal of phosphorus from phosphorus-rich manganese ores, especially of southern Orissa, has been developed. Success has also been achieved in reducing the phosphorus content of manganese ores of Madhya Pradesh and Maharashtra using dilute mineral acids. A process for the recovery of zinc from the waste solid residue of the zinc plant, known as

moore cake, has been developed. The discovery of nickel- and cobalt-bearing laterites in Orissa has assumed great significance because India is totally dependent on the import of this strategic metal. The laboratory is developing a hydrometallurgical process for the extraction of nickel and cobalt from the lean laterites of Orissa. Work on the biochemical leaching of low-grade ores in general, and copper ores in particular, has been initiated. Utilizing iron ore fines and volatile and low-ash non-coking coals from Talcher, the laboratory is developing a process for the production of sponge iron. Work on the beneficiation and pelletization of iron ore fines from Daitari and Gandhamardan deposits has been taken up. The laboratory has also initiated work on the beneficiation of bauxite, synthetic rutile from ilmenite obtained from the beach sands of Gopalpur, and utilization of coke-breeze, mill-scale, L. D. and blast furnace dust of the Rourkela Steel Plant.

With the setting up of the new Mineral Processing and Pyro- & Hydrometallurgical Laboratories, RRL is fully equipped to provide solutions to a number of metallurgical problems including beneficiation and utilization of lean and complex minerals. These two laboratories will play a greater role in mineral processing and extractive metallurgy.

The Director mentioned that the laboratory was planning to set up in the near future a number of process evaluation units which would help considerably in establishing the commercial feasibility of the processes and products developed in the laboratory.



CSIR Management Training Programme : Third Course on Materials Management

In continuation of the holding of the two courses on Materials Management involving purchase and stores officers of the national laboratories in the eastern and southern regions, the third course was organized at the Regional Research Laboratory (RRL), Jammu, from 3 to 10 September 1973 to cover the national laboratories situated in the northern region. Dr C. K. Atal, Scientist-in-charge of the laboratory, inaugurated the course and Mir Nasrulla, Divisional Commissioner, Jammu, was the guest-in-chief. Shri K. G. Krishnamurthi, Secretary, CSIR, delivered the key-note address.

Forty participants (comprising stores and purchase officers, accounts and administrative personnel and senior scientists) attended the 7-day course. Thirty lectures were delivered, six exercises were gone through and a few case-studies were presented. The main topics on which lectures and discussions were held were : development of CSIR organization; materials planning *vis-a-vis* R & D planning, techniques and procedures of procurement; inventory control; materials management performance indicators; evaluation of materials management; legal problems in purchase; concepts and techniques in materials management; and human relations. Certain recommendations were made for implementation at the laboratory level. The course emphasized the importance of materials management as a service function to R & D projects because of the fact that 40-50% of the total laboratory budget is consumed for the purchase of materials/equipment, etc.

The course highlighted the problems of intermeshing the mechanics of project planning and materials planning and the need for interaction of materials managers at various levels of project planning. An active purchase committee in a laboratory could form a focal point for the cooperation between the scientists and the materials

managers. In the context of mutual understanding between the scientists and materials managers in deciding the lead time sufficiently ahead of project execution, the present delay in materials procurement and issue and concomitant high costs could be avoided. Stores and purchase officers could follow some elementary forecasting techniques in the field of materials planning. As a solution to the cost problem, it was felt that bulk orders should be placed instead of piecemeal purchases. The participants were unanimous that a new CSIR manual for stores and purchase procedures be brought out.

Certain concepts like ABC analysis, economic order quantity (EOQ) and codification and classification of inventories were discussed as tools of inventory management and control. It was felt that instead of spreading the control too thin over all the items, it would be economical to concentrate control on a fewer but more important items. This control could start from the stage of indenting, pass through the placing of purchase orders and, ultimately, to the point of inspection, stocking and issue. With regard to purchase procedures, the need was felt for a centralized organization for coordinating purchase activities and other areas in the field of materials management. The pros and cons of purchase through the Directorate General of Supplies and Disposal were discussed. In order to locate and develop vendors for smooth purchases, a survey of existing trade directories was suggested.

In the field of inventory control were discussed various measures like provision of suitable warehousing facilities; appropriate methods of stores record-keeping like Cardex; detection and disposal of surplus and obsolete stores; process of issuing the materials and the problem of sub-stores at the scientist level.

Lectures delivered were concerned with internal audit of stores, budgetary control, stores accounting, etc., and highlighted the basic objective of materials management functions, viz. procurement for R and D projects of right

goods at the right time at the right cost.

Performance of Festoon Air Drier of Hindustan Photo Films Improved by NAL

Studies aimed at improving the performance of a festoon air drier, which dries and conditions several types of emulsion coated on film backing materials, have been carried out by the National Aeronautical Laboratory (NAL), Bangalore for Hindustan Photo Films Manufacturing Co. Ltd, Ootacamund. The problem concerned the high rejection rates of films processed in this drier.

The drier is a long, two-floored, U-shaped tunnel in the top floor of which the film passes along in the form of a continuous festoon and drying air passes across. There are two major circulation paths for the drying air. The overall circulation path, involving fresh, treated atmospheric air, is generated by a set of two blowers. Inter-linked with this is the other local-velocity-augmenting-circulation path which is powered by a series of 26 small fans. This latter local-circulation device offers much higher velocities of drying air over the film, in effect permitting the much preferred low drying temperatures. Dampers in air ducts and temperature monitors along the tunnel drying area help maintain any desirable 'drying environment' in terms of temperature distribution along the length of the tunnel. The drying space of the tunnel is about 2 m wide, 2 m high and 130 m long.

Following preliminary observations on the non-uniformity in the flow of the drying air, detailed measurements with flow detection instruments showed severe non-uniformity. The flow was non-uniform not only along the length of the drying area but also across it. Non-uniform flows could cause unequal drying of the film and lead to its eventual rejection. It was further noted that the drying temperatures had to be maintained at rather

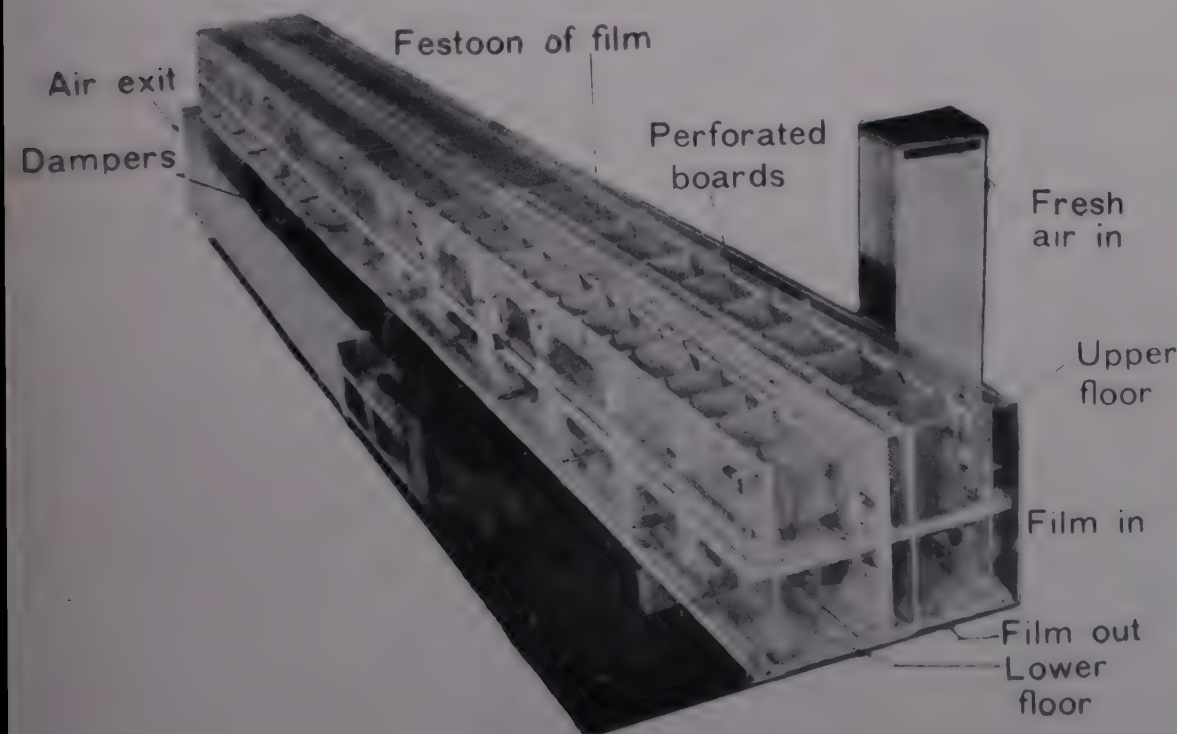
high levels in the drying area to ensure complete drying of the film before it passes out of the drier. The extent to which the fans, dampers and flow-distributing plywood boards caused this effect was therefore separately examined in relation to the design specifications.

The two large fans generating the overall circulation path were found from *in-situ* measurements to match the design specifications. The other local-circulation-augmenting fans could not be checked for performance in the installed condition because no simple method of flow measurement could be devised for their conduits. A separate fan test bed was built and a typical fan was tested on the same. The fan was found to deliver 25% less flow output as compared to the design specification. It therefore became clear that these fans would not be adequate for the successful operation of the drier, especially if the drier is expected to continue to operate on the 'recirculation' principle. After detailed studies on the possible alternatives for improving this situation, it was decided from economy considerations to change the operation from 'recirculation' principle to 'co-circulation' prin-

ciple. This change required only end-to-end reversal of the existing fans so that the local circulation path of drying air is in the same direction as the overall circulation pattern. A few trial runs of the drier on this newly evolved co-circulation principle showed encouraging results.

The dampers, which were found to be leaky, were replaced by better sealing sliding-vane type dampers as a result of which a much better control of flow could be obtained. Perforated plywood boards on the sides of the drying area were found to be not very effective in producing a uniform flow distribution. Fine mesh screens were therefore attached to these boards to ensure uniform air flow in the drying area.

As a result of these improvements the film drying rates could be doubled even at considerably lowered drying temperatures. Other associated units like emulsion coating system and film web drive system have now been set suitably to run the film at speeds which are high enough to match the enhanced capacity of the drier. This has now resulted in much higher film production rates at low rejection levels.



Model of festoon air drier of Hindustan Photo Films. The performance of the drier was improved by NAL, Bangalore.

CMRS Develops Gravimetric Dust Sampler

A gravimetric dust sampler, which can be used in mines and other industrial units for regular dust assessment and control of health hazards, has been developed by the Central Mining Research Station (CMRS), Dhanbad.

Standard dust sampling instruments of indigenous make are not available in the country. Collection of dust and its assessment by number count is done with imported midget impinger or thermal precipitator.

The instrument fabricated by CMRS cuts out completely dust particles of size 7.1μ and 50% of particles of a size of 5μ unit density spheres. The bigger dust particles are deposited on the floor of a series of horizontal elutriators provided for the purpose. Particles of respirable size are then trapped on a filter paper from the stream of air sample. The mass of dust collected on the filter paper gives the concentration of the respirable fraction of the dust in a known volume of air. The sample of dust thus collected over a long period can also be used for determining the chemical composition.

A portable unit, the sampler operates on a 6-V battery. Except the filter paper, all the components used in it are indigenous.

Acclimatization of Insects to Different Temperatures and Action of Insecticides on Acclimatized Insects

Physiological changes occurring in the American cockroach (*Periplaneta americana*) following acclimatization of the insects to different temperatures and the action of various insecticides on acclimatized insects have been studied by Smt. Kaiser Jamil (nee Miss A. Kaiser Jehan Bano) of the Regional Research Laboratory (RRL), Hyderabad, under the direction of Dr M. B. Naidu of the laboratory.

Criteria have been established to know whether an insect is acclimatized to a particular temperature on the basis of variations in the frequency of heartbeat at different temperatures,

acetylcholine titre, specific gravity of haemolymph, pH of haemolymph and unsaturation of lipids. Cockroaches subjected to temperatures of 33° and 15° C for acclimatization showed irregular rate of heartbeat for 25 days and 40 days respectively, regular frequency being observed thereafter; at room temperature (28°C) the heartbeat frequency showed variation during the period of acclimatization but not later.

The amount of acetylcholine varied considerably as did the heartbeat frequency during the period of acclimatization and not thereafter, showing thereby a direct relationship between the acetylcholine content and the heartbeat frequency.

The specific gravity of the haemolymph showed variation during the course of acclimatization as did the heartbeat frequency and acetylcholine content before stabilization occurs. This shows that cockroaches remain in a constant state of flux in their physiology for a certain length of time before they are fully acclimatized to a particular temperature.

The pH of the haemolymph of male as well as female cockroaches acclimatized to 33° and 15° C temperature was also studied. The pH of the haemolymph of female cockroaches was more alkaline than the pH of haemolymph of males when the insects were acclimatized to 33° and 15°C.

The iodine value was initially more in cockroaches acclimatized at 33°C but later a gradual decline was observed up to a period of 25 days and thereafter there was no variation.

Based on these observations, it has been concluded that certain physiological changes occur during acclimatization so that the insects adjust themselves to the new environment. This adjustment takes 25 days at 33°C and 40 days at 15°C. To judge whether an insect is acclimatized to a particular temperature the heartbeat frequency could be taken as an index.

The toxicities of endrin, toxaphene, heptachlor, malathion, parathion and sevin to cockroaches acclimatized at

two different temperatures 33° and 15°C and also to cockroaches maintained at room temperature (28°C) were studied. It was found that cockroaches acclimatized at 33° and 15°C when tested at their respective acclimatization temperature exhibited resistance to insecticides as compared to cockroaches maintained and tested at 28°C. However, cockroaches acclimatized at 33° and 15°C when tested at room temperature (28°C) showed increased susceptibility to the same insecticides. This may be due to the fact that acclimatized cockroaches are resistant to insecticides at their acclimatization temperature since they have adjusted themselves to the new environment by suitable compensation in their physio-

logy and any change in their acclimatization temperature disturbs the stabilized condition and makes them more susceptible.

Cockroaches acclimatized at 15°C when tested with sevin at 28° or 15°C showed increased susceptibility, thereby showing that sevin has a negative temperature coefficient.

These observations point to the conclusion that acclimatization affects the toxicity of insecticides, making them more resistant at their acclimatization temperature but susceptible at other temperatures.

The researcher, Smt. Kaiser Jamil was awarded the Ph. D. degree of the Osmania University in September 1971 for her thesis relating to the studies.

PROGRESS REPORTS

ATIRA Annual Report : 1972-73

The annual report of the Ahmedabad Textile Industry's Research Association (ATIRA), Ahmedabad for 1972-73, published recently, records the progress of R & D work under the following disciplines : Spinning technology; Weaving technology; Chemical technology; Basic studies; Engineering; and Instrumentation. Besides, the 64-page report contains a brief report from the director highlighting the association's activities in various areas during the year under review.

To train UAR technicians in the use of the technology of the permanent press process for cotton-polyester blend fabrics, following the licensing agreement with that country, a plan was finalized.

Development work in the industry-sponsored project on a durable press finish for all-cotton shirtings and suitings has been completed. The performance of shirts made from some of the fabrics has been satisfactory. On the other hand, trousers produced on the two-step process tended to be stiff. This drawback has been overcome through a modified single-step process and the use of suitable, newly synthesized softeners.

Substitution of sodium hydrosulphite has been extended to continuous vat dyeing and 30% substitution of hydrosulphite has been possible without adverse effects on the depth, tone or brightness of shade. Thickeners based on indigenous gums have been developed to replace sodium alginate in printing with reactive dyes. An adhesive for the preparation of printing screens has been developed. A flame proofing agent which gives excellent flame retardancy, freedom from afterglow and satisfactory wash-fastness has been synthesized and conditions of synthesis have been standardized.

Basic research, sponsored by national and international agencies, was pursued in the three major fields : (i) structure and physical properties of cotton and its physico-chemical modifications; (ii) chemical modifications of cotton and other polysaccharides to impart durable functional properties; and (iii) mechanism of reaction at the fibre/solution interfaces. Studies on the swelling of cotton fibres have led to the development of a more efficient process of partial acetylation. By varying the conditions of treatment it has been possible to obtain partially acetylated products spanning a wide

range of physical and chemical properties. Methods have been standardized for the measurement of crease recovery on fibre pads. Significant results have been obtained in the study of never-dried cotton. A number of carbamates and acid amides capable of conferring functional properties on cellulose have been synthesized and evaluated.

As many as nine projects were investigated under the sponsorship of ATIRA members. The project on new techniques of spinning, a long-term project of national importance, was continued under CSIR support.

Significant progress has been made with regard to the design and development of process control equipment. An improved dual drier has been designed; manufacturing drawings and design know-how have been supplied to the licensee and a commercial prototype is being fabricated. The wet bulb thermometer to optimize drying conditions on the stenter has given

satisfactory performance in mill trials. Attempts are under way to convert this instrument into a recording-cum-control device. A pilot scale U-rope washing machine has been fabricated and is being evaluated.

An improved model of top arm roller pressure gauge has been developed; this is lighter, more compact and easier to use than its predecessor. A rapid abrasion tester for testing fabric abrasion resistance has been developed. Prototypes of the tester have been tested in member mills and found satisfactory.

Under the consultancy and technical services of ATIRA, 28 operational surveys and 96 major consultancy problems were undertaken and technical services rendered to member mills.

Fifteen patents were accepted and 10 were filed. Twenty-three research papers were published, and 7 research reports and 7 survey reports were brought out.

The unit is capable of giving better than 550 lines resolutions and can withstand 45°C for continuous operation. The monitor was displayed at an exhibition and was appreciated.

All the components except the deflection yoke, line output transformer and linearity coil are available indigenously.

Oscilloscopes, voltage sweep generator, voltage and wave monitors, comparator bridges, TV camera and video distribution amplifiers, vacuum tube voltmeters and multimeters are some of the important items of plant and equipment.

The minimum capacity of an economically viable unit suggested is 1200 monitors per annum. The total capital outlay for a plant of this size has been estimated at about Rs 10 lakh (Rs 6.50 lakh on building, plant and machinery, and Rs 3.50 lakh as working capital). The cost of production has been estimated at about Rs 1400 per unit.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

TV Video Monitor

In closed-circuit TV system, the TV camera acts as the pickup transducer and a video monitor as the reproduction transducer. In the faithful reproduction of an object, TV video monitor has an important role to play. The definition, linearity and contrast are a few of the important characteristics of the monitor.

The Central Electronics Engineering Research Institute, Pilani, has designed and developed a TV video monitor for use in high-quality closed circuit television systems, suitable for CCIR 625 lines standard. The design incorporates a hybrid unit utilizing indigenous tubes and semiconductor devices, and 110°C radiant cathode ray tube which provides extra-large brilliant pictures. For convenience and flexibility of operation the following controls are provided on the front panel: horizontal and vertical hold; linearity, height, width, brightness and contrast.

Specifications of the TV video monitor developed at CEERI are as follows:

Scanning system	: 625 lines, 50 fields per second interlaced or random interlaced
Input signal	: 1 to 1.4V p-p composite video waveform (peak white, positive, sync. negative)
Input impedance	: 75 ohms or more
Video bandwidth	: 6 MHz within — 2db 8 MHz within — 3db
Resolution	: 550 lines at the centre of the picture
Scanning linearity	: within 5%
Power supply	: 230 V, \pm 10% 50 Hz at 150 W

Know-how for the manufacture of TV camera and video and pulse distribution amplifier required for closed circuit TV is also available.

Laboratory investigations have been carried out successfully and the specifications aimed at have been achieved.

TV Pulse Generator

To produce stable pictures the television receiver should have good hold-in and pull-in ranges in the flywheel circuits of the horizontal sweep generator. In order to ensure these characteristics, elaborate set-ups, which include the use of digital counter for accurate determination of frequency ranges, are required.

An inexpensive TV pulse generator has been developed by the Central Electronics Engineering Research Institute, Pilani. It generates pulses of stable frequency (stability better than 0.07%) which can be varied by \pm 5% around the nominal frequency of 15.625 kHz. It also provides crystal-controlled output at 15.625 kHz for accurate calibrations. This economizes on the investment on costly equipments, such as the sophisticated pulse generators and counters.

Specifications of the TV pulse generator developed at CEERI are as follows :

Oscillator frequency range	: 14.5 to 16.5 kHz
Stability	: better than 0.07%
Crystal frequency	: 15.625 kHz
Pulse width (present)	: continuously variable 4-6 μ s
Pulse amplitude	: continuously variable from 0.8 to 3.8 V
Pulse polarity	: positive and negative
Ambient temperature	: -10 to 45°C for continuous operation
Power supply	: 23V \pm 10%, 50 Hz, 28W

The generator has been tested for performance and found to compare well with the imported pulse generator in the same general category.

The main items of plant and machinery required are : oscilloscopes; counter; comparator bridge; tube tester; vacuum tube voltmeters and multimeters; milling, shearing, drilling and group folding machines; lathe and pressess; and electroplating equipment.

All the raw materials are indigenously available. For the production of 300 units per year the cost of the raw materials is estimated at Rs 1.20 lakh.

The total working capital (90 days of manufacturing cost) is expected to be Rs 0.544 lakh and the total capital investment is expected to be about Rs 1.50 lakh.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

TV Antennas

Television programme reception involves the use of a wide band communication channel. Particular care should be taken at every stage of the signal processing, and the antenna forms an important item for good quality reception.

Three types of antennas, viz. two-element and four-element yagi antenna and a table model indoor antenna, for channel four have been developed by the Central Electronics Engineering Research Institute (CEERI), Pilani to meet the requirements of : (i) primary region where signal strengths

are large; (ii) secondary regions where the signal strengths are relatively weaker; and (iii) fringe areas where the signal strengths are very low and highly directive antennas become essential.

At present only three-element yagi antenna is being manufactured indigenously. TV sets in the fringe areas are not being installed presumably because of the non-availability of well-designed antennas. Also, indoor antennas are not being installed due to the same reason. Specifications of the antennas developed by CEERI are as follows :

Two-element yagi antenna

Gain	: 3 db
Front-to-back ratio	: 8 db
Input impedance	: 300 ohms (balanced)

Four-element yagi antenna

Gain	: 6 db
Front-to-back ratio	: 16 db
Input impedance	: 300 ohms (balanced)

Table model antenna

Gain	: 2.5 db
Input impedance	: 300 ohms (balanced)

A number of antennas of each type have been fabricated and tested keeping in view CCIR specifications which have been used as guidelines.

All the raw materials are available indigenously. The minimum capacity of a economically viable unit for manufacturing antennas is 2500 units per annum. For such a unit the total investment required is Rs 1.2 lakh. The costs of production of two-element antenna, four-element antenna and table model antenna have been estimated at Rs 77, 120 and 60 respectively.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Mixer, Power and Stereo Amplifiers

High-fidelity sound systems constitute a substantial part of entertainment electronics. A number of high-fidelity components having excellent perform-

ance specifications and satisfying the requirements of the most critical listener have been developed by the Central Electronics Engineering Research Institute, Pilani. Among the components developed are a 8-channel mixer, a 15-W amplifier and a 30-W stereo amplifier. An important feature of the developmental work is the use of indigenous components and materials. These components can be used to form high-fidelity sound systems for entertainment purposes. The extremely low distortions and the high power capabilities of the amplifiers make them highly suitable for both domestic and public entertainment. Specifications of the high-fidelity components developed by CEERI are as follows :

8-Channel mixer

Frequency response	: 20 Hz to 20 kHz (—1 db) 14 Hz to 45 kHz (—3 db)
Low impedance channels	: 5, 50 ohms
High impedance channels	: 3, 1 Mohms
Treble variation	: 10 db at 10 kHz
Bass variation	: \pm 10 db at 100Hz
Cross talk	: 45 db
Max. output voltage	: 1 V open circuit

Solid state power amplifier

Max. power output	: 16 W rms
Distortion at rated output	: 0.4%
MUO at 5% distortion	: 12 W
Frequency response	: 50 Hz to 20 kHz (—1 db) at 2.5 W 17 Hz to 100 kHz (—3 db) at 2.5 W

Input for rated output	: 750 mV
Output impedance	: 8 ohms
Input impedance	: 1 Mohm

Stereo amplifier

Max. power output	: 10 W
Distortion at rated output	: 0.6%
MUO at 5% distortion	: 12 W
Frequency response	: 50 Hz to 20 kHz (—1 db) at 2.5 W 17 Hz to 100 kHz (—3 db) at 2.5 W
Output impedance	: 8 ohms
Input impedance	: 1 Mohm
Channel separation	: 35 db
Input for rated power	: 20 mV

The units have been displayed at various exhibitions and their performance was highly appreciated.

All the components and raw materials are available indigenously.

The minimum capacity of an economically viable unit would be 600 units of mixer amplifier, and 1000 units each of power amplifier and stereo amplifier per annum. For such a unit the total fixed capital investment has been estimated at Rs 5 lakh out of which a sum of Rs 85 000 would be in respect of plant, machinery and testing equipment. The cost of production of mixer, power and stereo amplifiers has been estimated at Rs 350, 200 and 400 respectively.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

PATENTS ACCEPTED

Indian Pat. 129451

Improvements in or relating to a method for the agglomeration of chrome ore fines using inorganic binders

R. Sahoo & B. R. Sant
RRL, Bhubaneswar

The bulk of the chrome ore deposits in Orissa is either low-grade ferruginous type or chemically high-grade friable type, mostly occurring in the Sukinda ultrabasic belt of Cuttack district. In view of the paucity of metallurgical grade chrome ore in the country, especially in the context of expanding alloy and steel industries, utilization of the friable ore and the concentrates that may be obtained through beneficiation of low-grade ores has assumed importance. Agglomeration appears to be the most suitable technique for this purpose. The patent under reference relates to the method developed to suitably agglomerate, or pelletize, friable chrome ores, chrome ore concentrates or the naturally occurring chrome ore fines using very small quantities of inorganic binders.

The process is as follows : The ore fines or concentrates are ground to -300 mesh, thoroughly mixed with 0.5-1.5% by weight of a suitable inorganic

binder such as sodium silicate, bentonite, or sodium chloride in combination with limestone or without it and the mixture is rolled for about 30-60 min in a laboratory model rotating drum (15 in. diam and 5 in. depth) in the presence of a suitable quantity of moisture to obtain pellets of about 10 mm diam. These pellets, which have acquired sufficient green strength for normal handling, are heat-hardened for about 90 min in three stages, viz. (i) drying at 200-300°C to remove moisture, (ii) pre-heating at 700-800°C, and (iii) finally hardening at about 1200°C. The chrome ore pellets so obtained were found to have necessary compression and abrasion strength and could be used for metallurgical purposes.

Indian Pat. 129188

A process for synthesis of 2, 2-dialkyl-3, 4-diphenylchromenes

S. Ray, P.K. Grover & N. Anand
CDRI, Lucknow

This invention relates to the synthesis of 2, 2-dimethyl-3-phenyl-4-(*p*-pyrrolidinoethoxy)phenyl-7-methoxychromene and related compounds. Such compounds have significant estrogenic activity and can prevent the implantation of fertilized ova and thus have the possibility of being used as antifertility agents. These compounds also owe their importance as intermediates for the preparation of *trans*-2,2-dialkyl-3,4-diphenylchromenes, a group of promising orally active post-coital antifertility agents presently under clinical investigation.

The synthesis of the representative compound 2,2-dimethyl-3-phenyl-4-(*p*-pyrrolidinoethoxy)phenyl-7-methoxychromene starts from 2, 4'-dihydroxy-4-methoxybenzophenone which is condensed with phenylacetic acid to give 3-phenyl-4-(*p*-acetoxy)phenyl-7-methoxycoumarin which is subjected to Grignard reaction with methylmagnesium iodide after its alkaline hydrolysis. Alkylation of 2, 2-dimethyl-3-phenyl-4-(*p*-hydroxy)phenyl-7-methoxychromene with β -pyrrolidinoethylchloride hydrochloride gives the title compounds.

Indian Pat. 129452

Door and window-pane sliding mechanism
S. K. Banerjee & M. S. Banerjee
CMERI, Durgapur

With the increasing use of airconditioning in tropical countries, prevention of leakage at doors and windows poses a serious problem because of rising costs, operating troubles and difficulties caused by frequent power shutdowns. When airconditioning cannot be provided, mechanized ventilation is a must for large auditoria, and also for faster railway coaches, buses, lifts and basement floors. Ventilation should be well distributed for uniform control of temperature, moisture and pollution, and must ensure exclusion of dust and insects. But neither airconditioning nor mechanized ventilation is possible without a mechanism for closing the doors and window-panes—a device which provides a positive seal against leakage of air or rattling.

The invention, covered by the patent under reference, overcomes this problem in respect of those doors and window-panes which slide parallel to wall. The pane is guided in guide-grooves or rails and is slid by either hand, or rack-pinion, ratchet, pulley-chain or wire rope or tape or belt, or link mechanism. A characteristic feature of the mechanism is that at the completion of the closing operation the pane is mechanically clasped at the boundary chowkat between a peripheral thrust-pad juxtaposed with a soft sealing bead. This stops all possibilities of rattling, or ingress of dust or moisture, or leakage of pressure or air-mass in any direction. Again, at the beginning of an opening operation of the pane, the clasp hold of the pane is first released and can be easily slid in its guide.

Doors and windows can be fitted in foodgrain godowns or general warehouses to prevent breeding of pests; in furnaces and ovens to save heat and fuel and prevent fumes from escaping; and in space-heated living areas in cold countries. Its greatest utility appears to be in automotive mass transport and

mail-express or crowded suburban trains in offering passengers option to throw open the windows whenever the compartment becomes stuffy and unhealthy with sudden stoppage of air-conditioning or forced ventilation. The invention thus eliminates one main difficulty in, or objection against, introduction of more airconditioned or forced-ventilated or pressurized coach service in the railways. It could be of equal utility in other countries facing similar heat and dust problems.

Indian Pat. 131606

Improvements in or relating to a process for the preparation of gamma ferric oxide
L. Singh, A. M. Chavan & A. N. Kotasthane
NCL, Poona

This patent relates to a process for the preparation of non-stoichiometric black oxide of iron and gamma ferric oxide in the form of finely divided powders of substantially uniform size.

Gamma ferric oxide is usually prepared by first heating finely divided ferrous oxalate at a certain temperature and in an inert atmosphere when black ferrosferric oxide of iron is produced, and then oxidizing the latter in air under controlled conditions.

In the patented process, the first stage, namely production of black oxide of iron from ferrous oxalate, is carried out more easily in a current of steam than in other inert atmospheres when the reaction proceeds at a lower temperature (400°-450°C). requires less time for completion, and results in a final product with better magnetic properties. Ferrosferric oxide formed under the conditions described above picks up oxygen spontaneously so that its chemical composition and crystalline structure approach those of gamma ferric oxide although the colour remains black. Unlike conventional ferrosferric oxide, this non-stoichiometric black iron oxide is stable, and can be used as such for many applications, such as the formation of magnetizable coating compositions for recording tapes. It is ferromagnetic in nature having a coercive

force of 300-600 oersteds and remanent induction of 1600-2300 gauss.

This non-stoichiometric black oxide of iron is converted into conventional gamma ferric oxide by damping with water and heating in air at about 150°-250°C until the black colour changes to brownish red. Gamma ferric oxide thus obtained has a coercive force of 300-600 oersteds and a remanent induction of 1600-2300 gauss.

The advantage of this process is that the chances of solution or fusion of particles are avoided, especially because of low temperature of decomposition of ferrous oxalate, so that the non-stoichiometric black iron oxide formed in the first stage, and the brownishred gamma ferric oxide obtained as the final product, are both predominantly pseudomorphs of the original crystals of ferrous oxalate, which should consist of particles of substantially uniform size with a diameter of about 1 μ or less.

Tanners Get-together at CLRI

The Leather Week and the Tanners Get-together, annual features of CLRI's activities, will be held from 31 Jan. to 6 Feb. 1974 at the Central Leather Research Institute (CLRI), Madras. The get-together will be organized as group discussion in four technical sessions devoted to: (1) Finished leathers; (2) Footwear and leather goods; (3) Views forum; and (4) CLRI research programmes for 1974-75.

The last date for submission of papers is 1 December 1973. Further information may be obtained from: The Conveners, Ninth Tanners' Get-together 1974, Central Leather Research Institute, Adyar, Madras 600020.

Get-together of CECRI Scientists and Industrialists/Entrepreneurs

The get-together of scientists and industrialists/entrepreneurs [CSIR News 23 (1973), 140] will now be held on 2 December 1973; CECRI scientists will be available for specific consultation at CSIR Madras Complex on 3 Dec. 1973.

Bhatnagar Memorial Awards : 1970 & 1971

Nine scientists have been named for Shanti Swarup Bhatnagar Memorial Awards for the years 1970 and 1971. The Governing Body of CSIR approved the awards at its meeting held on 31 August 1973. The recipients of the awards for the years 1970 and 1971 in the various subjects are as follows:

Physical Sciences : Dr P. K. Iyengar, Head, Nuclear Physics Division, Bhabha Atomic Research Centre, Trombay, Bombay (1971).

Chemical Sciences : Dr P. T. Narasimhan, Professor of Chemistry, Indian Institute of Technology, Kanpur (1970); Dr M. M. Dhar, Scientist, Central Drug Research Institute, Lucknow (1971).

Medical Sciences : Dr J. R. Talwar, Assistant Professor, Cardiothoracic Surgery, All India Institute of Medical Sciences, New Delhi (1970); Dr A. K. Maiti, Reader in Physiology and Head, Department of Biochemistry and Biophysics, University College of Medicine, University of Calcutta, Calcutta, and Dr O. D. Gulati, Professor of Pharmacology, Medical College, Baroda (1971).

Biological Sciences : Prof. M. S. Kanungo, Professor of Zoology, Banaras Hindu University, Varanasi and Prof. N. Balakrishnan Nair, Professor of Marine Biology and Fisheries and Head, Department of Aquatic Biology and Fisheries, University of Kerala, Trivandrum (1971).

Engineering Sciences : Dr A. Bhattacharyya, Professor of Mechanical Engineering, Jadavpur University, Calcutta (1971).

PATENTS FILED

114/Mas/73 : A chemical method of interfacial polymerization of polyesters and polyamides on the surface of cellulosic fibres to prolong their wear life, K. Sreenivasan & A. R. Kalyanaraman—SITRA, Coimbatore.



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NO. 21 & 22

Pectin from Citrus Wastes

The requirements of pectin for fruit processing industries are mostly met by imports. An integrated process for the production of pectin, calcium citrate and lime oil from citrus pomace and peel available from fruit processing factories has been developed by the Central Food Technological Research Institute, Mysore. Complete technical know-how and plant lay-out have been released to an industry and the plant is being installed.

Walnut Processing and Storage

In traditional practice, walnuts after harvest are dehulled manually, washed and sun-dried. This results in the splitting of kernels, development of dark colour and contamination by fungi. Studies carried out at the Central Food Technological Research Institute, Mysore, have indicated that these drawbacks could be overcome by hastening the dehulling operation and drying in a drier fabricated at the institute. India exports nearly 5300 tonnes of walnut valued at about Rs 22 million.

Albumen from Trash Fish

The Central Food Technological Research Institute, Mysore, has developed a process for the production of albumen from trash fish (annual catch, about 70 000 tonnes) and miscellaneous fish of low fat content. The yield of albumen is about 8% of the starting material. Proteinaceous material could also be obtained from shrimp waste (annual availability, 30 000 tonnes).

Fumigant Tablet for Rural Storage

The Central Food Technological Research Institute, Mysore, has deve-

loped a minifume tablet containing the fumigant adsorbed on a cardboard disc and covered with outer polythene and Kraft paper for use in village storages. The shelf-life of the tablet is about 6 months and can be extended up to 9 months at higher temperature (45°C) by bulk packaging in tins and glass jars.

Ninth International Congress of Biochemistry

Dr C. R. Krishna Murti, Head, Biochemistry Division, Central Drug Research Institute, Lucknow, participated as a member of the Indian delegation (sponsored by the Indian National Science Academy) in the Ninth International Congress of Biochemistry held at Stockholm from 1 to 7 July 1973. The congress covered the following nine areas of biochemistry: (1) Separation methods for macromolecules; (2) Structure and function of proteins; (3) Biosynthesis of nucleic acids and proteins; (4) Bioenergetics; (5) Membrane biochemistry; (6) Immunochemistry; (7) Metabolic function of oxygenases; (8) Regulation of intermediary metabolism; and (9) Biochemistry of lipids. Under each section there was a symposium which included lectures by eminent authorities who reviewed the developments in their respective areas and presented a large number of free communications.

Furthermore, four colloquia were organized: (i) Biochemistry of the extracellular matrix; (ii) Molecular evolution; (iii) Biochemistry of synaptic transmission; and (iv) Polypeptides with hormonal, toxic or antibiotic properties.

The colloquia highlighted developments in methodology and techniques

and critical interpretation of analytical data. As in the previous congress plenary lectures were delivered. Those delivered at this congress were: (i) The evolution of enzymes by Dr B. S. Hartley of MRC Laboratory of Molecular Biology, Cambridge; (ii) Interaction among cellular membranes by Dr George E. Palade of the Rockefeller University, New York; (iii) Electron transfer and energy conservation by Prof. E. C. Slater of the Laboratory of Biochemistry, University of Amsterdam, the Netherlands; and (iv) Molecular probes for a viral etiology of human cancer by Prof. S. Spiegelman of the Institute of Cancer Research, College of Physicians and Surgeons, Columbia University, New York.

Proteins and nucleic acids

In his plenary lecture, Prof. S. Spiegelman described the properties of the reverse transcriptases in oncogenic viruses isolated from animals and discussed the validity of the theory that every cell contains in its DNA segment coding for a tumour virus but struck a note of caution that the data obtained with human neoplastic cells do not provide supporting evidence for this 'virogene' hypothesis.

Bioenergetics

There is vigorous pursuit of membrane systems exhibiting electron transport activity from a diverse species of cells. Because of the key role played by ATPase in linking electron transfer to phosphorylation and fixation of energy in chemical bonds, the latter enzyme has received considerable attention. ATPase has been shown to be an oligomer made up of five different polypeptide chains and the fully conformed molecule is bound to mitochondrial membrane by a relatively

small molecular weight protein. Anti-mycin, oligomycin and aurovertin (a polypeptide ATPase inhibitor) have proved useful molecular probes to reveal interaction between the different polypeptide chains of ATPase, the cytochrome electron acceptors and the non-haem proteins, leading to the eventual process of ATP synthesis. Slater referred to the 20-odd electron acceptors, already identified in mitochondrial fractions, and stressed the importance of rapid EPR measurements at 5-35°K for probing into the functional non-haem proteins involved in coupling electron transport to phosphorylation.

From the discussion at the symposium session and the free communications the vector translocation theory proposed by Mitchell as early as 1958 appeared to be gaining greater currency.

Membrane biochemistry

In recent years the interest in molecular biology has shifted towards the elucidation of the key role of the membrane or membrane-bound organelles in overall metabolism of the cell. Techniques for the isolation of plasma membranes from a variety of mammalian and microbial tissues are available now, and employ a judicious combination of cell disruption procedures, density gradient centrifugation, characterization of precise marker enzymes and functional studies in transport or binding of ions, drugs or metabolites. Receptor sites on membranes or specific receptor proteins for insulin, adrenalin, corticosteroids and sex steroids were described.

In his thought-provoking plenary lecture, Palade outlined the various aspects of the phenomena of fusion-fission of membranes involved in the intracellular transport and discharge of secretory proteins in compartmentalized subcellular structures such as endoplasmic reticulum, Golgi complex, secretion granules, lumen or tissue space. There appears to be a biogenetic relationship among membranes. Membranes are initially produced in ER, transported to and modified in Golgi complex and finally inserted as plas-

malemma on the cell surface. Striking differences are noticed among membranes in their lipid and protein composition and enzymic activity. Membranes may fuse intermittently but do not apparently interchange their constituents by lateral diffusion. The role of lysosomes in membrane dissolution during cell death and the consequent exertion of a feedback regulation on membranogenesis is an area of intensive investigation. Smooth and rough endoplasmic reticulum of mammals modified by barbiturates or membrane structures isolated from primitive organisms such as amoeba have proved extremely useful in such studies.

Regulatory mechanisms

In this area efforts are being continued to isolate and study at depth regulatory enzymes such as glutamic dehydrogenase or isocitric dehydrogenase in addition to classical aspartate transcarbamylase or fructose diphosphate aldolases. The ubiquitous role of membrane-bound adenylylase and the related protein kinases in the regulation of intermediary metabolism was highlighted in a number of symposium lectures and free communications. The role of polypeptide hormones in the differentiation of cells is being tackled from the nature of signal transduction in membranes. Cyclic AMP and Ca^{2+} together appear to be involved in mediating phosphorylation of proteins required for the activation of many regulatory enzymes. Using data obtained with the liver and the smooth muscle and the sex organs, efforts are being made to elucidate phosphorylation of proteins and changes in intracellular levels of cyclic AMP, in relation to the biochemical events preceding or accompanying synaptic transmission.

Separation methods

Considerable interest was shown in the newer technique of hollow fibre membrane dialysis to separate and purify macromolecules. This technique may eventually replace concentration by ultrafiltration under pressure with single membranes. However, in elegance and simplicity of equipments

needed, Sephadex gel filtration with G25 or G50 with an efficiency of 100% in desalting and protein recovery still remains the best technique for both analytical and preparative work on the separation of macromolecules from simple anions and cations.

Dr Krishna Murti presented three papers at the congress. He also attended the colloquium on 'Biochemistry of Microbial Development', organized by the Biochemical Society, UK, at the University of Oxford, Oxford (10-11 July 1973); the 'International Symposium on Subcellular Methodology' and the 'Lysosome Course', organized by the Wolfson Bioanalytical Centre at the University of Surrey, Guilford (12-14 July 1973 and 16-18 July 1973 respectively).

Oils as Synergists to Synthetic Insecticides

A study has been made of synergism between oils and their components extracted from the seeds of various indigenous plants—*Pongamia glabra* (karanja), *Acacia arabica*, *Datura alba*, *Sesamum indicum* and *Melia azadirachta* (neem)—in combination with synthetic insecticides (isolan, pyrolan, sevin, endrin, heptachlor, malathion and parathion) with the object of exploring new synergists and to understand the mechanism of synergism. The studies were made by Miss Subhashini Abraham of the Regional Research Laboratory, Hyderabad under the supervision of Dr M. B. Naidu of the laboratory.

The toxicity of insecticides was studied by applying them to male and female houseflies and cotton bugs. Karanja oil showed the highest degree of synergism and sesame oil the lowest while oils of *Acacia*, *datura* and *neem* were found to be intermediate in their synergistic action irrespective of the type of insecticide, insect species and their sex. Karanja and sesame oils however, exhibited antagonism with malathion and parathion against houseflies and cotton bugs. Generally, it was found that oils were inferior in synergism as compared to their respective components.

Karanjin from karanja oil was found to synergize the insecticides more than pongamol extracted from karanja oil and sesamin from sesame oil.

The degree of synergism seemed to depend upon the innate toxicity of insecticides to insects and also to vary with the insect species. For instance, sevin, which was less toxic to houseflies than pyrolan and isolan, showed a higher degree of synergism in combination with karanjin, pongamol or sesamin. On the contrary, in cotton bugs sevin was found to be more toxic than pyrolan or isolan, and in combination with any of these components showed a lesser degree of synergism, while pyrolan being less toxic showed a higher degree of synergism. These results hold true for both male and female cotton bugs.

Female insects, which were more resistant to insecticides than males, showed a higher degree of synergism than males. This resulted in the reduction of sex difference in toxicity of insecticides when mixed with synergists as compared to that observed with the insecticide alone. With heptachlor, however, the degree of synergism observed in male and female houseflies and cotton bugs was almost the same as the two sexes were equally susceptible to the insecticide.

The unsaponifiable matter separated from *Acacia* and datura seed oils when mixed with malathion and parathion and tested against houseflies and cotton bugs produced relatively more synergism than the respective oils both in cotton bugs and houseflies while karanjin, pongamol and sesamin exhibited antagonism. Karanjn, pongamol and sesamin also showed antagonism against red cotton bugs when mixed with heptachlor.

The degradation mechanism of insecticides was studied using GLC. The results showed that a lesser amount of the insecticide was present in females than in males. But, in the presence of synergist, the amount of insecticide extracted in the bodies of female flies was more than in males. These results suggest that the mecha-

nism of detoxification of the insecticide is more pronounced in females than in males and consequently, female insects exhibit more resistance than males. However, in the presence of the synergist the detoxification of the insecticide is interfered with, more so in females than in males, with the result that female insects exhibit a higher degree of synergism than males.

The research worker, Miss Abraham, was awarded the Ph. D. degree of the Osmania University for her thesis relating to the studies.

Pashudhan aur Kukkut Palan

This volume, issued as a supplement to *Bharat ki Sampada : Prakratik Padarath*, the Hindi series corresponding to The Wealth of India : Raw Materials, has been brought out recently by the Publications & Information Directorate, New Delhi. The publication is the Hindi version of the Livestock (including Poultry) supplement of The Wealth of India. The volume deals with all the aspects of the livestock wealth of the country including poultry under one cover. The main sections of this supplement are : Cattle and Buffaloes, Sheep, Goats, Pigs, Horses and Ponies, Donkeys and Mules, Camels, Yaks, Chemistry of Livestock Products, Marketing and Trade, and Poultry.

In each section information on breeds and breeding, feeds and feeding, diseases and control, livestock products and their economic uses, etc. are

dealt with. Poultry, being an important industry by itself, has been treated separately at the end. This section includes, besides description of the breeds, brief accounts on feed and feeding, poultry diseases, poultry products and their utilization, and marketing and trade. Exotic breeds, many of them now introduced in India, have also been dealt with in considerable detail. The statistical information has been made up-to-date in the light of changes that have occurred since the original livestock supplement was issued.

As in the earlier volumes of *Bharat ki Sampada*, metric system of weights and measures, Arabic numerals and English system of chemical symbols have been adopted, and technical terms approved by the Commission for Scientific & Technical Terminology for Hindi have been used.

The binomial nomenclature is accompanied by folk names wherever it is possible. All the biological Latin names used in the description of species have been compiled in English at the end to facilitate such readers as would like to have specialized knowledge of the subject from standard English works.

The 242-page (demy 4to) publication is profusely illustrated and contains a bibliography and an index, and would be useful to research workers, students, agriculturists, industrialists and all those interested in the particular field of study.

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

Tannin Extract based on Tamarind Seed Husk, Myrobalan and Babul

The Central Leather Research Institute, Madras has developed a new tannin extract based on tamarind seed husk. It can be used as a partial substitute for wattle extract (imported) in tanning process. Besides, it has applications as water softening agent for boiler feed water, and the byproducts

can be used as fuel, manure and in hardboard manufacture. It is expected that about 2000-3000 tonnes of this extract manufactured annually can replace 10-15% of the wattle extract. The tannin extract is prepared by a simple leaching process using tamarind seed husk, myrobalans and babul bark as raw materials. Samples produced in a pilot plant over a period of two years have been found to be suitable for sole/heavy leathers and have been

accepted by consumers. The yield of the product is 30% by weight of raw materials.

The main raw materials needed in the process are tamarind seed husk, myrobalan and babul bark, and all these are available indigenously.

The basic equipment for a 3-tonne extract per day unit are boiler (1 tonne per hr), evaporator (1 tonne per hr water evaporation), and spray drier (200 kg per hr water evaporation) or vacuum pan (200 kg per hr water evaporation).

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Berberine Hydrochloride from *Berberis lycium*

Berberine hydrochloride is used in the preparation of drugs for the treatment of diarrhoea and eye troubles. The exact internal demand or consumption is not known but the product has export potential, particularly to Japan.

The Regional Research Laboratory, Jammu, has developed a process, on a pilot plant scale, for the production of berberine hydrochloride using the roots and root barks of *Berberis lycium* Royle plant as the raw material. This plant grows in plenty in the north-west Himalayan region.

Disintegrators, stainless steel jacketed vessels, centrifuges, stainless steel trays and wooden vats are the major items of plant and machinery required. All these can be fabricated in the country.

The yield of berberine hydrochloride is 1.7 kg per quintal of raw material. The laboratory has assumed 3 tonnes per year as the optimum capacity of the plant. The capital outlay for a plant of this size is estimated at about Rs 5.5 lakh (Rs 3.5 lakh on plant and building, and Rs 2 lakh as working capital). The cost of production of berberine hydrochloride has been estimated at Rs 190-200 per kg. The present market price is about Rs 250 per kg.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Hyoscine Hydrobromide from *Datura stramonium*

Hyoscine is an important alkaloid which is in great demand by pharmaceutical industry, and is being imported. Approximately 30 kg of hyoscine hydrobromide are consumed annually by the pharmaceutical industry and the demand may go up to 50 kg per annum in the near future.

By a simple extraction process (Fig. 1) developed by the Regional Research Laboratory, Jammu, this important alkaloid can now be produced in the country from the leaves of *Datura stramonium* which grows in plenty in the north-western Himalayan region. Benzene, ethylene dichloride, sulphuric acid and chloroform are the chemicals required in the manufacture of hyoscine and these are easily available. The main items of equipment are disintegrator, extraction apparatus, filters, storage tanks and pumps, and all these can be easily fabricated in the country. The product has been produced on a pilot plant for two years and the quality conforms to IS specifications.

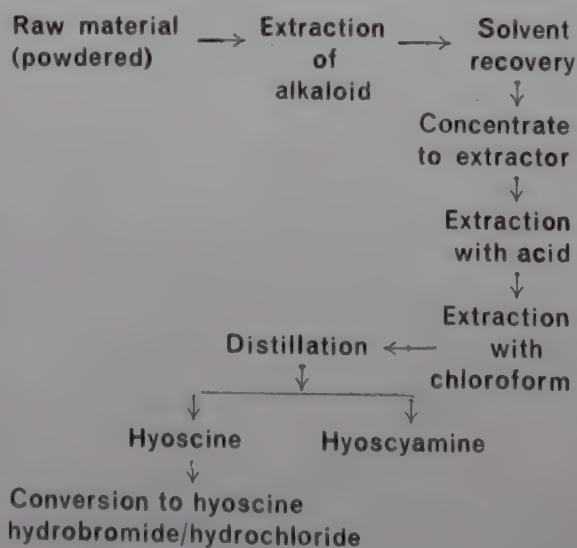


Fig. 1—Flowsheet for production of hyoscine hydrobromide/hydrochloride from *Datura stramonium*

The yield of hyoscine hydrobromide per quintal of *D. stramonium* leaves is

100 g, and hyoscyamine is obtained as byproduct. The suggested plant capacity is 30 kg of hyoscine and 50 kg of hyoscyamine per annum. The present market price of hyoscine hydrobromide is Rs 10 000 per kg.

The total investment on the plant and buildings is estimated at about Rs 6 lakh (Rs 4 lakh on plant and Rs 2 lakh on buildings), and the working capital at about Rs 2 lakh.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

High Slag Masonry Cement

Most desirable properties of masonry mortars for brick, stone and block work are good workability, high water retention against suction, cohesiveness, good bond strength and greater resistance to volume changes. Conventional portland cement and sand mortars lack in these properties. Addition of lime to portland cement in the proportion of 2 : 1 or 1 : 1 by volume with 6 to 9 parts of sand has been found to be effective in improving upon these properties of lime but because of high cost its use is not popular in India. In many countries masonry cement consisting of portland cement and fillers like limestone, fly ash and granulated slag along with a small amount of an air-entraining agent are commonly used for mortar work. These are ground extremely fine to achieve high workability. Mortars prepared with masonry cement are considered somewhat superior to composite mortars in overall performance.

A masonry cement consisting of cement clinker ground with granulated slag, requisite amount of gypsum and a small amount of an indigenous air-entraining agent has been developed by the Central Building Research Institute, Roorkee. The masonry cement developed at the institute conforms to all the physical requirements stipulated in IS : 3466-1967.

At present high slag masonry cement is not being used, and the conventional

cement and sand mix is used for masonry. However, conventional mortar lacks in important desirable properties, namely workability and water retentivity. The demand for masonry cement is likely to increase.

A number of mixes have been prepared in the institute in a ball mill of capacity of 40 kg. The cement has been used for masonry of walls, etc.

The main raw materials are cement clinker conforming to IS : 269-1967, granulated slag to chemical requirements of IS : 455-1967 and gypsum of not less than 75% purity. All the raw materials are available indigenously.

High slag masonry cement is resistant to sulphate attack and hence its use will prevent efflorescence in brickwork. The masonry cement is expected to cost about 7.5% less than portland cement. The mortar produced would be more economical than the cement sand or composite mortar. The process is recommended to those firms only which are manufacturing cement as it would be uneconomical to set up tube-mills, etc. needed for this process independently.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Manufacture of Hydrated Lime

Lime, with its manifold uses, is an excellent time-tested building material. However, it suffers from the drawback of perishability, as it is easily contaminated with atmospheric moisture and carbon dioxide. One method of retaining the useful properties of lime is to hydrate it before storing. This treatment also results in the elimination of the core and the other extraneous materials and thus concentrates the active constituents. When lime is stored properly its good properties are retained at least for two months in bulk and for a longer period in proper type of bags. The hydrated lime has been found useful both as plastering material and for use in mortars.

A hydrator for hydrating lime has been developed by the Central Build-

ing Research Institute, Roorkee. The following are the special features of the hydrator:

(1) It is a sturdy machine having three tiers and occupying little space.

(2) The three tiers have well-defined functions. The first tier acts as pre-mixer. Hydration mainly takes place in the middle tier. In the third, hydration is completed and the material is dried.

(3) The steam generated during hydration is utilized for pre-heating the incoming water. This accelerates the process of hydration.

(4) By a simple manipulation of the machine the process can be altered in such a manner that the rate of movement of the material can be changed so that different periods of contacts can be obtained to suit the nature of the lime.

(5) The machine is capable of being transported as a single unit and hence it may be possible to carry and use it at the site of actual use.

Because of its well-defined properties hydrated lime has definite advantages in handling, storage and transport; also

it can be incorporated into plasters and mortars in exact proportions although it has the demerit of containing about 25% water as an integral constituent. Because of these advantages the demand for hydrated lime for building constructions is increasing. Additionally it has many uses in chemical and other industries.

A prototype has been designed, fabricated and commissioned. It can hydrate about 6-7 tonnes of lime (of average reactivity) per day. It has been tested in the laboratory; field trials lasting a few weeks have also been carried out. The prototype is working satisfactorily at Dehra Dun.

A plant of 2-2½ tonnes per shift capacity has been estimated to cost Rs 20 000. The capital investment for a plant of about 2000 tonnes per annum capacity is estimated at Rs 1.06 lakh and cost of production at about Rs 126 per tonne.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

CSIR SUPPORT TO RESEARCH

Completed Schemes

Crystal Structure Analysis of Rare-Earth Metal Complexes

Recently there has been an increasing interest in the crystal chemistry of lanthanide ions. To date, a number of complexes of lanthanides with different ligands have been prepared and characterized by physico-chemical methods. The bonding of the ligands to the lanthanide ions is essentially electrostatic with little interaction between the 4f orbitals and the ligand orbital.

Because of their comparatively large size the lanthanide ions exhibit a high coordination number, usually between six and ten. The lanthanide contraction plays an important role in the coordination chemistry of lanthanides. As the size of the lanthanide ion decreases the repulsion between the ligands in the coordination sphere increases

and becomes large enough to make the structure unstable. At this point, the coordination number of the lanthanide ion decreases and the crystal structure changes.

With a view to correlating the effect of lanthanide contraction with the changes in the coordination number and crystal structure, a programme of elucidating the structures of lanthanide complexes having different ligands was taken up by Shri K. Krishna Bhandary, a CSIR research fellow, working at the Department of Inorganic & Physical Chemistry, Indian Institute of Science, Bangalore, under the guidance of Dr H. Manohar and Dr K. Venkatesan. It was also the object of the study to understand the coordination geometry and crystal chemistry of lanthanides. As part of this project, a series of complexes of dimethyl sulphoxide (DMSO) with lanthanide

nitrates was taken up for X-ray crystallographic studies. These complexes have been found to have the general formula $\text{Ln}(\text{NO}_3)_3 \cdot n\text{DMSO}$, where $n=4$ for $\text{Ln}=\text{La}$ to Gd , and $n=3$ for $\text{Ln}=\text{Y}$, Ho and Yb .

In the case of the lanthanum complex, preliminary single-crystal X-ray photographs showed that the complex crystallizes in the monoclinic system with cell dimensions $a=14.94 \text{ \AA}$, $b=11.04 \text{ \AA}$, $c=15.54 \text{ \AA}$ and $\beta=109^\circ 10'$. From the systematic extinctions observed in the Weissenberg photographs the space group could be either $C2/c$ or Cc . From morphological and crystallographic considerations the space group $C2/c$ was chosen. The intensity data of hkl ($l=0$ to 10) reflections were collected and the intensities of 1257 reflections were estimated visually.

The structure was solved by the heavy atom technique. The heavy atom (La) position was obtained from a three-dimensional Patterson synthesis. The R-factor with the heavy atom position was 35%. A three-dimensional Fourier map was computed using the phase obtained from the La position. From the positions of La and S and the chemical information available the positions of other atoms were obtained. With all the atoms the structure factor calculation gave an R-factor of 25%. The final R-factor with anisotropic thermal parameters for all the atoms was 9.4%. In the last stages of refinement the scattering factors of La^{3+} were corrected for anomalous dispersion.

The La^{3+} ion was found to be coordinated to the oxygen atoms, six from the three nitrate groups and four from the four DMSO groups. Thus the coordination number of La was found to be 10 instead of 8 as suggested by physico-chemical studies. The coordination polyhedron around La^{3+} ion can be described as two pentagonal pyramids sharing a common edge. The coordinating distances $\text{La}-\text{O}$ were found to be between 2.48 \AA and 2.71 \AA . The bidentate nitrate groups were found to be planar within experimental error. The DMSO groups were found

to be pyramidal, and coordinate through the oxygen atom.

The second structure in this series, $\text{Yb}(\text{NO}_3)_3 \cdot 3\text{DMSO}$, was studied in order to see how the lanthanide contraction affects the coordination number and the crystal structure. The complex was prepared as suggested by the earlier workers and was recrystallized from acetonitrile.

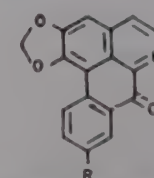
Examination of rotation and Weissenberg photographs about c -axis taken with $\text{CuK}\alpha$ radiation showed that the DMSO complex of $\text{Yb}(\text{NO}_3)_3$ crystallizes in monoclinic system with unit cell parameters $a=10.08 \text{ \AA}$, $b=12.74 \text{ \AA}$, $c=16.02 \text{ \AA}$ and $\beta=100^\circ 30'$. From the observed systematic absence the space group was uniquely determined to be $P2_1/c$. This suggests that the structure is different from the lanthanum complex though both crystallize in the same system. Intensity data were collected with $\text{CuK}\alpha$ radiation for reciprocal levels hkl ($l=0$ to 10) and were estimated visually. The intensities were placed on the same scale by correlating the data with the cross-layer data collected about another axis. The Yb atom position was obtained from a three-dimensional Patterson synthesis. The coordination of the Yb atom was refined to an R-factor of 30%. Successive difference Fourier maps were computed and the positions of all the atoms were obtained. The structure was refined with isotropic temperature factors for all the atoms to an R-factor of 12.4%. The refinement is in progress.

In the antipyrine complex of neodymium nitrate the effect of the bulky antipyrine ligand on the coordination sphere of the rare-earth metal is being studied.

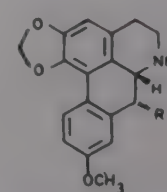
Chemical Investigation of Magnoliaceae Species

Under a research programme pursued at the Department of Pure Chemistry, University of Calcutta, Calcutta, Dr A. Patra, an *ad hoc* CSIR research fellow, undertook chemical investigation on the constituents of some *Michelia* species (Magnoliaceae), indigenous to India, for novel chemotaxonomic

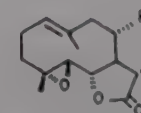
relationship. The studies, carried out under the supervision of Dr S. K. Talapatra, Reader in the Department, led to the isolation of a few unknown neutral and basic constituents along with some previously characterized compounds. Of the different parts of three *Michelia* species screened, the trunk bark of *M. lanuginosa* was found to be the richest in the number of compounds present. From the basic constituents were isolated along with the known oxoaporphine liriodenine (=1,2-methylenedioxyoxoaporphine)(I), the new oxoaporphine alkaloid lanuginosine (=9-methoxy-1,2-methylenedioxyoxoaporphine (II) [*Chem Ind.*, (1969),1056] and the new nonphenolic noraporphine michelanugine (=7-hydroxy-9-methoxy-1,2-methylenedioxy-noraporphine) (III). Their structures were settled from spectral studies and from chemical correlation with xylopine (9-methoxy-1,2-methylenedioxy-noraporphine) (IV). Michelanugine (III) forms a hydrochloride and non-basic O, N-diacetate and is oxidizable to lanuginosine (II). The stereochemistry of 6a-H and 7-H of michelanugine are settled to be *cis* from rotational data, PMR characteristics and decoupling experiments.



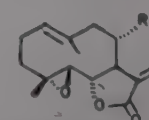
I, R=H, Liriodenine
II, R=OCH₃, Lanuginosine



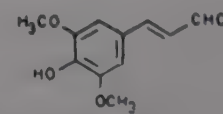
III, R=OH, Michelanugine
IV, R=H, Xylopine



V, R=H, Dihydroparthenolide
VI, R=OAc, Lanuginolide



VII, R=H, Parthenolide
VIII, R=OAc, 11,13-dehydro lanuginolide



IX, Sinapaldehyde

From the neutral fraction of the extracts of the above plant two new germacranolides, dihydroparthenolide (V) and lanuginolide (8 α -acetoxydihydroparthenolide) (VI), were isolated.

Their structures and stereochemistry at different asymmetric centres as also absolute conformation were tentatively settled from chemical properties and PMR data of the parent compounds and their derivatives [*Chem. Commn.*, (1971), 1534].

From the less mature trunk bark of the same plant were isolated two other germacranolides. One was identified as parthenolide (VII) and the other, a new germacranolide, as 11, 13-dehydrolanuginolide (= 8 α -acetoxyparthenolide) (VIII). The stereochemistry of the latter was settled from its chemical correlation with lanuginolide. Dihydroparthenolide and lanuginolide, however, could not be isolated from this plant material. Sinapaldehyde (IX) was also isolated from the latter collection of *M. lanuginosa*.

The leaves and root bark of *M. lanuginosa* and the trunk bark of *M. cathcartii* were found to contain the oxoaporphines, liriodenine and lanuginosine, whereas the leaves, trunk bark and root bark of *M. excelsa* contained liriodenine only. Parthenolide was present in the root bark of *M. lanuginosa*, the leaves of the same plant, and the different parts of *M. cathcartii* and *M. excelsa* contained only sitosterol and a fatty alcohol as the neutral constituents.

PATENTS ACCEPTED

Indian Pat. 132582

An improved process for the production of a fungal acid protease useful, for example, as a bating agent in leather manufacture and as a digestive aid

A. Thangamani, R. K. Ghose & P. K. Goswami

IEM, Calcutta

Proteases (protein-hydrolyzing enzymes) have many uses in industry and medicine. Some of them are used (i) as bating agents in the manufacture of leather, (ii) as digestive aids, (iii) in the preparation of protein hydrolysates which are useful as pre-digested foods for the convalescent and the sick and in microbiological work, and (iv) in the prevention of 'chill-haze' in beer. Acid proteases can also have some special applications because of their activity and stability at low pH. Thus, in

the manufacture of leather, acid bating has the advantage of combining the two steps of bating and pickling into one step. In the processing of furs, alkaline conditions must be avoided to prevent the hair from getting loosened and therefore acid bating is preferred. Acid proteases which are active and stable at the pH of the stomach (1.8-2.5) can be used as aids to gastric digestion of proteins.

There is no indigenous production of such acid proteases at present. The demand for bating enzyme is about 400 tonnes per annum, and most of it is met by import. About 5 tonnes of pepsin are imported annually and partly used in pharmaceutical preparations, as digestive aid.

The present patent covers a simple and economical process for the production of a fungal acid protease, active and stable in the pH range 1.8-4.0, wherein the mold is grown as solid culture and the enzyme product is obtained both as a crude powder and in a partially purified form. The crude powder has been tested as a bating agent for the manufacture of garment leather in the tannery at the Central Leather Research Institute, Madras, and it has given good results. The process for the production of the crude powder has been scaled up to 10 kg per lot per day. As this product is about 4 times as active as the imported bates, it can be diluted 4 times with an inert material. Thus the unit process studied is capable of producing 40 kg of bating agent per lot per day. On the basis of this rate of production, the cost of production works out to about Rs 2.70 per kg of bate. The price of imported bates is about Rs 5 per kg.

The equipments required for the production of the crude powder are: kneader for preparing the nutrient medium, autoclave, and a drying oven which can dry semi-solids at room temperature. An air-cooler will be required for the culture room if the room temperature is above 28°C. For the unit process described above, the cost of equipments will be about Rs 30 000.

Indian Pat. 86156

Amides of pharmacological interest

M. B. Husain, G. T. Rajan, G. S. Sidhu & S. H. Zaheer

RRL, Hyderabad

The invention covered by the patent relates to the preparation of a new series of heterocyclic amides, which are expected to be pharmacologically active. N-Acyl derivatives of substituted or unsubstituted morpholine, piperidine and 1, 2, 3, 4-tetrahydroquinoline are reacted with dialkylamine, piperidine or morpholine to obtain the title compounds. The intervening acyl chain is straight or branched and contains up to four carbon atoms.

Indian Pat. 131589

An apparatus to count the number of warp and weft yarns in cloth

J. L. Mathur

CSIO, Chandigarh

The apparatus, covered by the patent under reference, is used for determining yarn density in cloth by counting the number of warp and weft yarns under controlled illumination using either incident or transilluminated light. In the case of low-density cloth the sample is transilluminated from below and in the case of high-density cloth an incident light is used from above. In both the cases the observations can be made accurately and in quick succession as the sample is mechanically, and precisely, movable under uniform tension. A number of readings can be taken without resetting the instrument, only moving the sample to and fro by rotating two knobs on the front panel of the instrument. Special features of the instrument are:

- (1) Two incident light sources mounted on the stage of the instrument for inspection of high-density cloth are universally adjustable and inclinable in all directions. The light spot obtained is free from shadow effect and is continuously adjustable in size and intensity of illumination from maximum to minimum.
- (2) The bottom source of light is also in three steps of varying illumination provided with a colour filter pocket for viewing the sample

under light of desired colour for inspecting partly washed-out colours in the sample.

- (3) The apparatus is fitted with a mechanical device by which the cloth sample in the form of a strip can slide to and fro precisely and conveniently under uniform tension. This device permits the operator to obtain several sets of readings at different places of the specimen without disturbing the set-up of the apparatus.

Indian Pat. 131258

A developer for developing an electrostatic latent image on a photoconductive plate used in electrophotographic machine

P.C. Mehendru, D.C. Parashar, G.D. Sootha, Devendra Singh, Narendra Kumar & Suserla Subrahmaniyam
NPL, New Delhi

The developer used for developing the electrostatic latent image on photoconductive plates used in electrophotographic machines consists of two parts: (i) toner, and (ii) carrier. In general, the toner material must be pulverizable or dispersible into fine particles, must be capable of accepting and retaining electrical charges, and should have no adverse effects on the photoconductive plate. The carrier particles, slightly bigger in size than the toner particles, must also be capable of accepting and retaining electrical charges, opposite in polarity to the charges on toner particles.

The process covered by the patent enables the utilization of a homogeneous mixture of a pigment, a resin, a plastic or moulding powder and wax for making the toner powder, and spherical beads of glass, resin, porcelain or the like for making the carriers. The process of making the toner consists in grinding the mixture of the pigment, resin, plastic and wax in a certain proportion to 20 μ particle size and mixing the toner with carrier particles of size 0.5 mm in the ratio of 1 : 100 approximately (by volume).

The electrostatic latent images developed with this developer can be fixed by vapour fixing or heat fixing methods.

Indian Pat. 130060

A process of formulating corrosion inhibiting compositions for steel in acid solutions

N. Subramanyan, S. K. Rangarajan, K. Balakrishnan, S. Venkatesan & B. Sathianandham
CECRI, Karaikudi

Articles made out of steel have to be invariably cleaned by pickling to remove mill scale and rust before they could be given surface coating (paints or metallic coatings). Pickling is generally carried out by dipping the steel article in 5-20% hydrochloric acid or hot sulphuric acid for 5-20 min.

In the process of pickling, some amount of the base metal will also be removed by the pickling acid, apart from rust. Moreover, part of the hydrogen produced during pickling will enter the metal structure and make it brittle. This is called hydrogen embrittlement which impairs the structural strength of the material.

To avoid the loss of the base metal during pickling, various types of corrosion inhibitors like formaldehyde, amines and thiourea are added to the pickling liquor. Some of them are very effective as corrosion inhibitors but are not useful in preventing absorption of hydrogen by steel. In fact, compounds like thiourea actually enhance permeation of hydrogen into the metal. On the other hand, amines are comparatively not very effective as corrosion inhibitors but considerably hamper the absorption of hydrogen.

The process covered by the patent exploits the beneficial aspects of the two types of substances in pickling steel, namely corrosion inhibition and minimizing hydrogen uptake. Thus, mixtures of sulphur-containing compounds like thiourea and of compounds like amines and aldehydes have been found to be very effective as corrosion inhibitors and in minimizing hydrogen absorption. In fact, the combinations have been found to decrease hydrogen absorption to a greater extent than even the corresponding individual constituents. A typical formulation is a mixture of thiourea, formaldehyde and hexamine in suitable proportions.

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126664 : An automatic flushing cistern for urinals, Ishwar Singh—CBRI, Roorkee.

127174 : A process for the recovery of zinc and carbon electrode from waste dry cells, M. S. Iyengar, J. L. Ghose, R. K. Chakrabarti & R. Haque—RRL, Jorhat.



CSIR NEWS

A FORTNIGHTLY HOUSE BULLETIN OF CSIR

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NO. 23

Permanent Adhesive for Cloth Fixation on Screen Printing Table

At present nylon georgette fabrics are fixed on the screen printing table with pins, and this process is time-consuming. Moreover, unless the pins are fixed very close to each other, some distortion of the fabric, and consequently of the printed design, is inevitable. The Silk & Art Silk Mills' Research Association, Bombay has developed a suitable adhesive for fixing the cloth on the table. It could be used for a number of printings of the same design and will thus save considerable amount of time. Increase in printing productivity and assurance of damage-free printed fabrics are the concomitant advantages.

Blasting and Drilling Investigations at Bailadila Iron Ore Project

Under the sponsorship of the National Mineral Development Corporation, the Central Mining Research Station, Dhanbad took up investigations to determine the technical causes of unsatisfactory performance at the Bailadila Iron Ore Project (Bastar Dist., Madhya Pradesh). During the investigation, which lasted about four months, CMRS developed a relationship between the strength of the rock, the energy ratings of the drill machine and the drilling rate. The theoretical results were in agreement with the actual drilling data. A method has also been found not only for making a judicious selection of drill machines based on the rock strength data but also for predicting optimum drilling rates in various rocks for a given drill

design. The optimum drilling rates of the available drill machines were predicted for the Bailadila Iron Ore Project. Changes in various parameters that will result in improved drilling rates have also been suggested to the mine management.

Electrostatic Hazard during ANFO Explosive Loading

The introduction of ammonium nitrate fuel oil (ANFO) explosive to the mining industry in India, especially in regard to underground mining, is very recent. During its use it is possible that a static electricity charge built up results in the development of high potentials, which if discharged through the blasting cap may cause premature firing of explosives. The Central Mining Research Station, Dhanbad took up an investigation at the Khetri Copper Mines of the Hindustan Copper Ltd with a view to predict and prescribe the degree of safety in the operational conditions of ANFO loading, in particular the danger of premature detonation of the explosive due to static electricity. A report on the investigation was submitted to the concerned authorities.

Efficiency of Hydraulic Stowing Plant at Hindustan Lalpeth Colliery

As a result of investigations carried out by the Central Mining Research Station, Dhanbad it has been possible to improve the stowing rate by one and half times at the Hindustan Lalpeth Colliery, Chandrapur. The laboratory also supplied a design of mixing arrangement for stowing through a borehole. With this arrangement a high concentration of sand could be carried into the mine, and consequently

considerable savings in the cost of pumping water could be effected. With the high rate of stowing the number of man-hours required in the operation was reduced and the rate of extraction of coal increased.

Dynamics, Chemistry and Thermal Processes in the Thermosphere : International Symposium

Dr A.P. Mitra of the National Physical Laboratory, New Delhi, participated, as a member of the delegation sponsored by the Indian National Science Academy, in the international symposium on 'The Dynamics, Chemistry and Thermal Processes in the Thermosphere' held in Kyoto from 9 to 21 September 1973. Two major areas which aroused considerable interest were: (i) Outstanding solar flare events of August 1972; and (ii) Dangers of changes in atmospheric environment due to supersonic aircrafts. Brief accounts of these two sessions, which Dr Mitra has prepared, follow.

Outstanding solar flare events of August 1972

The first ten days of August 1972 witnessed a series of catastrophic Solar Flare Events that have aroused great interest for many reasons. The events occurred during the declining stage of the solar cycle, and were the largest recorded since November 1960. The geomagnetic storm of 4-6 August was a great one and that of 9 August was the third largest of the year. Disruptions to telecommunications were the most severe in a decade. There were also reports that power lines and long-haul telephone cable systems were affected.

The magnetic field showed large gradients after the 4 August flare. Radio observations indicated a peculiar feature of polarization distribution across the active region favourable for the occurrence of a proton flare. A notable feature was the absence of type II bursts in the meterwave range except on 7 August. Observations were available from spacecrafts, balloons, lunar-based instruments and rockets and included X-ray, γ -ray and energetic charged particle emissions. There were 12 events in which X-ray energy fluxes exceeded 10^{-1} ergs cm^{-2} sec^{-1} .

Ionospheric observations revealed two periods of storminess separated by a short, partial-recovery period. The SIDs were numerous. Whistlers were observed at unexpected times during the day beginning on 4 August and persisted over most of the disturbed period.

Visual auroras were reported from many low-latitude places during the 4-6 August geomagnetic storm. Satellite drag measurements showed major increases in atmospheric density at 300-900 km altitude for both 4-6 August and 9-10 August disturbed periods. A significant jump in the length of the day was linked to the 2 August flare.

Two important areas of solar-terrestrial events were discussed for the first time, viz. (i) possible biological effects of magnetic pulsations, and (ii) outages in telephone cables and power stations. Madam Trotskaya, President of IAGA, reported on some preliminary observations made in USSR on the possible biological effects of solar-terrestrial disturbances as well as the results of a controlled experiment in which rabbits were exposed to magnetic pulsations with periods of about 10 Hz. The major features of the August 1972 event and of the results of artificial exposure of experimental animals to magnetic pulsations were nearly the same, and included change in cardiac rhythm, change of blood coagulation, and change of reaction time to a signal.

The Bell Telephone Laboratories described the effects of the large magnetic storm on the Bell system Long

Haul communication channels. The 4 August event caused a failure in the Casket Pilano area near Illinois at 22.40 hrs UT. The failure lasted about 30 min. The Bell Telephone scientists attributed these failures to the large changes in the magnetic fields during storm, causing induced currents to flow.

Environmental hazards due to supersonic aircrafts

In 1971 Crutzen and Johnston pointed out that SST fleets could add significant quantities of NO to the normal stratosphere, leading to a major reduction in stratospheric ozone through the reaction :



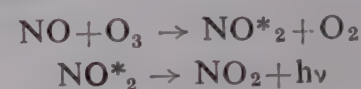
There is thus the danger of increase in the flux of ultraviolet radiation reaching the earth's surface. This could result in a variety of environmental consequences, including increase in skin cancer, cessation of tissue growth, albumen coagulation and ecological disturbances. The ozone issue played an important role in the political debate on SSTs in USA in early 1971 and was a factor in the eventual decision by the US Congress to freeze SST developments.

The possible dangers of fleets of Concorde and TU144s as well as SSTs that may be developed in future in USA necessitated intensive work on stratospheric chemistry and measurements of NO, NO₂, N₂O, HNO₃, CH₄, CO, H₂ and H₂O aerosols in the stratosphere by a combination of ground-based and balloon techniques. The new results of these activities formed a major subject of the symposium.

NO_x measurements in the stratosphere and mesosphere

One of the major requirements for modelling for NO_x and O₃ for normal conditions and as a result of NO injection from SST fleets is to know the concentration of NO_x and O₃ in the normal atmosphere. Two major experiments in this line were reported by Ackerman from Belgium, and Schiff from Canada.

Ackerman used a balloon-borne spectrometer that went up to 35 km and measured solar spectra in the infrared looking for absorption lines of NO, NO₂, CO₂ and H₂O. Schiff's measurements, also conducted with balloons, used chemiluminescence resulting from controlled injection of NO (1 ppm) and ozone from separate chambers carried in the balloon and allowing the following reactions to take place in a central chamber :



NO and NO₂ profiles along with mesospheric nitric oxide profiles obtained either directly with rockets (Meira) or from ionospheric constraints (use of ion composition, flare, ionization reversal, etc.) were presented. The latter were presented by Mitra in the session.

Environmental impacts of SSTs

Ozone depletion comes not merely from the reaction (O₃+NO) but also from the loss of free atomic oxygen through (O+NO₂). Possible SST effects were presented.

McElory considered several traffic models. These included: (1) 300 Concorde flying 7 hr/day; (2) a Concorde fleet with a traffic volume of 4.2×10^{11} passenger-km/year; (3) SST fleet with a traffic volume of 3.6×10^{11} passenger-km/year (each SST carrying 600 passengers and having a cruising speed of 3.2×10^3 km/hr, operating 7 hr/day); (4) a projected 1990 traffic model with a traffic volume of 5.9×10^{11} passenger-km/year, rising from present 4.4×10^{11} passenger-km/year; and (5) 300 TU 144, flying 7 hr/day. Cruising altitudes were taken to be 17, 20 and 25 km for Concorde, the SST and the HST.

Ozone depletion is 1% for the minimum traffic volume and can be substantially larger (5% or more) for larger traffic volumes. The decrease in temperature due to O₃ depletion can amount to as much as -10°K in the stratosphere. The effects of water vapour and hydrocarbon were found to be minor.

The role played by the equatorial stratosphere was presented. The ozone source in the equatorial stratosphere is carried into the troposphere mainly in

the winter hemisphere through stratospheric westerlies. An injection of NO in the equatorial stratosphere can be particularly damaging.

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

Door and Window Frames from Magnesium Oxychloride Cement and Saw Dust

Magnesium oxychloride cement has found many uses, viz. manufacture of flooring tiles, flooring compositions, wood wool building boards and other precast products. In continuation of the process developed for making magnesium oxychloride flooring tiles, the Central Building Research Institute, Roorkee has developed know-how for making door and window frames using magnesium oxychloride cement.

These frames possess adequate strength, good nailability and screw-holding property, machinability and paint-holding property. The frames can be easily cast and erected at site.

Magnesium oxide and dolomite powder are mixed with saw dust. Magnesium chloride solution is added, and the mixture is poured into the moulds with reinforcement in position. Thorough compaction is achieved, preferably by using a plate vibrator, and the surface smoothed by a trowel. Care is taken to see that the corners and edges are properly filled. All the vertical and horizontal members must be cast separately. Demoulding of frames is done some time after casting and air curing before the members could be assembled.

Moulds of required size may be made of either seasoned timber with GI sheet lining or of steel.

The magnesium oxychloride cement frames can be painted to any desired colour with an oil paint or emulsion paint. The cost of a magnesium oxychloride cement frame compares well with that of RCC frame and is about 33% less than that of a timber frame.

Further particulars may be obtained from: The Managing Director, Na-

tional Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Clay-Fly Ash Building Bricks

Fly ash is an important waste material obtained from thermal power stations which use pulverized coal. About 5 million tonnes of fly ash are being produced in the country, and the figure may go up to 8 million tonnes by 1981. There are some 35 thermal power stations producing fly ash in different parts of the country. Since the chemical composition of fly ash does not differ much from that of clay, a large amount of fly ash can be disposed of easily and profitably by making clay-bonded fly ash building bricks by a process developed by the Central Building Research Institute, Roorkee.

The brick industry is the largest building industry which can consume bulk of fly ash.

Fly ash generally contains 5-6% unburnt carbon. Its addition to clay therefore leads to better burnt bricks, besides economizing on coal consumption during firing. The reduction in coal consumption will partly solve the problem of coal shortage faced by brick manufacturers from time to time besides reducing production costs.

Fly ash can also be used for demoulding the bricks. Used in place of moulding sand, fly ash improves the texture of bricks. Incorporation of fly ash also reduces the drying shrinkage of bricks and is of particular advantage for black-cotton clays which produce drying cracks in bricks.

Addition of fly ash to clay in requisite proportion results in 15-25% reduction in the weight of bricks, which consequently have better thermal insulation.

Partial replacement of clay by fly ash for the manufacture of bricks results in the saving of clay. The main raw material, clay, therefore lasts for a longer period and delays the shifting of the kiln to the next site. The process also saves agricultural land. Clay-fly ash bricks can be used for all types of brick masonry.

There is always a large demand for building bricks in the country. As the addition of fly ash to clay does not change the properties of the bricks, clay-fly ash bricks can be used for all types of construction where conventional clay building bricks are used.

Two large-scale field trials have been conducted by the laboratory, and the bricks manufactured have been found satisfactory.

The raw materials—clay and fly ash—are easily available. Economics of production depends upon the distance of the source of fly ash from the kiln, the carbon content in fly ash and the amount of fly ash that can be mixed with clay.

The capital investment for a plant capable of producing 30 000 bricks per day or 72 lakh bricks per season is estimated at Rs 3.76 lakh for a mechanical mixing plant and Rs 4.42 lakh for a manual mixing plant. The cost of production per thousand bricks would be about Rs 52 and Rs 55 for mechanical and manual mixing plants respectively. The production cost of conventional clay bricks comes to about Rs 63 per thousand, and the total capital requirement for a plant manufacturing such bricks is about Rs 6.42 lakh.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Preparative Attachment for Gas Chromatograph

A gadget which can convert an ordinary gas chromatograph into a preparative gas chromatograph has been developed by the Regional Research Laboratory, Jorhat. The gadget will

enhance the versatility of a gas chromatograph and make it more sophisticated. A gas chromatograph having preparative attachment is suitable for collecting closely related compounds from a complex mixture. Pure components thus collected from the column effluent can be subjected to ancillary techniques of gas chromatography for chemical identification, which makes the gas chromatograph more applicable to research and industry.

In the present design, provision for collection of four different components has been kept, but with a slight modification eight different components can be collected in a single run. The preparative attachment is entirely automatic, and once programmed, does not need the operator's attention, though provision for manual operation is also made. Suitable electronic circuits enable the unit to collect any part of the sample. It is estimated that at least 500 pieces would be needed every year. These attachments are now being imported, and the market price varies from Rs 4000 to 5000 per piece.

The attachment has been tested with a laboratory gas chromatograph and has given very accurate results and consistent performance both under manual and automatic operation. The performance of the attachment can be demonstrated at the laboratory to interested parties.

With a working capital of about Rs 66 000 for a unit producing 60 pieces/300 days, the attachment can be made at a cost of about Rs 1560 per piece. The cost of production will be considerably less for a firm having its own workshop, and profitability is very high.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

General-Purpose Laundry Detergent

Synthetic detergent powders have become a commodity of mass consumption in India, and their demand is on

the increase because they are easier to use for washing purposes than soap. At present detergent powders are being manufactured by some big companies in India. Small-scale manufacturers, who account for 60-70% of the total production of soap, have no access to the field of detergent production, mainly due to lack of indigenous know-how and consultancy. In order to cater to the needs of such manufacturers the Regional Research Laboratory, Jorhat has formulated a cheap detergent composition which could be used as a general-purpose laundry powder. The main constituents of the formulation are : alkyl aryl sulphonate, which acts as the detergent slurry; sodium tripolysulphate, which improves the cleaning power and acts as water softener; and sodium perborate, which is a mild bleaching agent without adverse effects on the colour of the fabrics. Besides, such constituents as an optical whitener, a foam booster, a perfuming agent and a colouring agent are added to improve the quality of the powder. All the components required for making the formulation are indigenously available.

The process developed by the laboratory consists of mixing the required quantity of the optical whitener with hot water. A bluing agent is then dissolved in this solution. The resultant solution is added to the alkyl aryl sulphonate slurry, followed by other solid components. Sodium silicate is added towards the end. After thorough mixing the detergent slurry is spray-dried.

The quality of the products depends on the temperature and pH of the slurry.

Cost estimates for a small-scale industry producing 50 kg of detergent powder per day have been worked out by the laboratory. The total capital investment for such a plant has been estimated at Rs 16 000. The cost of production would be Rs 3.35 per kg as compared to the current market price of Rs 6.50 per kg for similar products, and thus leaves a wide margin of profit.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Dinitrosopentamethylene-tetramine (DPT)

Dinitrosopentamethylenetetramine is a blowing and foaming agent commonly used in rubber industries. When the compound is mixed with rubber mixture and heated, nitrogen is liberated and results in foamed rubber.

There is a considerable demand for DPT in the country; exact figures are not available, but it is expected that not less than 60-100 tonnes of this compound will be needed annually by the rubber industry. With the increasing utility of rubber, specially foamed rubber, the demand for DPT may further go up. The bulk of the present needs of rubber industries is met by imported substitutes. The present indigenous production of DPT, which is in short supply, is limited to some small-scale manufacturers. The starting hexamine is also an imported item, and consequently production costs are high.

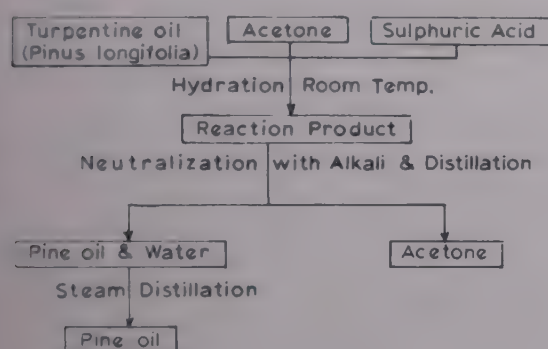
A process for the production of DPT based on indigenous raw materials has been developed by the Regional Research Laboratory, Jorhat. The process consists in reacting ammonia and formaldehyde to form a cyclized ring and finally introduction of nitroso group. The process has been developed on a laboratory scale of 1 kg per batch. The product has been tested and found to conform to the required standards.

The laboratory has assumed that a 15 tonnes per annum plant will be an optimum economically viable unit, and the capital outlay for a plant of this size is estimated at Rs 1 63 200 (fixed capital on building, plant and machinery including working capital). The cost of production comes to about Rs 15.50 per kg. The product can be sold at Rs 18.00 per kg, leaving a high margin of profit.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Pine Oil from Turpentine Oil

The Regional Research Laboratory, Jammu has developed a process for the production of pine oil from turpentine oil (Flowsheet). Pine oil is in great demand by the pharmaceutical and flavouring industries because of its cheapness and ease of production.



Flowsheet for production of pine oil from turpentine oil

Turpentine oil, some chemicals and solvents are the raw materials required, and all these are available easily.

The total capital investment for setting up a plant of 200 litres per day capacity has been estimated at Rs 4.5 lakh (Rs 1 lakh on building and Rs 3.5 lakh on equipments). All the equipments can be fabricated in the country. With a working capital of Rs 90 000 the product can be produced at about Rs 4 per kg.

Laboratory data have been confirmed by pilot plant tests and the product has been found to conform to IS specifications. The yield of pine oil is 70% by weight of turpentine oil.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Bisphenol A

Bisphenol A is widely used as an intermediate in the manufacture of epoxy resins and polycarbonates, which in turn find application in the production of surface coatings, structural plastics,

adhesives, etc. Bisphenol A is also used as an antioxidant. At present bisphenol A is being manufactured by a few firms on a small scale; indigenous production is reported to be around 300 tonnes per annum as against an estimated annual demand of 800-1000 tonnes. There is thus scope for establishing additional units for the production of bisphenol A in the country.

The National Chemical Laboratory, Poona has developed a process for the manufacture of bisphenol A starting from indigenously available raw materials. The process consists in condensing phenol with acetone in the presence of suitable catalysts. The process has been standardized on a pilot plant scale of 10 kg per batch of the finished product (yield, 85% based on acetone). The product is obtained in a clean white crystalline form and in a state of high purity (mp 154°-155°), and passes the specifications for use in epoxy resin manufacture. The product has been tested by a few firms who have found it suitable for the manufacture of epoxy resins.

Phenol, acetone, sulphuric acid, a few other chemicals and catalyst are the main raw materials required for the manufacture of this product. All these are available indigenously.

Reaction kettle (lead-lined or glass-lined), addition/washing vessels (mild steel/aluminium), centrifuge, drier, micropulverizer, distillation units, etc. are the major items of plant and machinery. All these are either indigenously available or can be fabricated easily in the country.

The laboratory has assumed 300 tonnes per annum as the optimum size for the plant. The capital for a plant of such a size is estimated at Rs 14.65 lakh (Rs 7.50 lakh on land, building and plant and machinery, and Rs 7.15 lakh as the working capital). The cost of production is estimated at Rs 7.67 per kg against a selling price of Rs 9.30 kg for the imported material.

Further particulars may be obtained from : The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

CSIR SUPPORT TO RESEARCH

Completed Schemes

Mechanism of Switching of High Speed Transistors, Tunnel Diodes and their Combination

Switching transistors have found wide application in digital and wave-shaping circuits. During the last few years, there has been a spectacular improvement in the switching speed of transistors, and other ultra high speed semiconductor devices have been made available. An effective use of such devices necessitates a deeper understanding of the physical process of the transients of such devices. Hence, a thorough investigation of the mechanism of switching of high speed transistors, tunnel diodes and their combination has been made by Shri Asok Srivastava, a CSIR research fellow, who carried out the studies under the guidance of Dr A. B. Bhattacharyya, at

the Department of Physics, Indian Institute of Technology, Delhi.

Transient response study of transistors

In most practical switching circuits, the transistor is driven by a constant voltage drive applied through a RC speed-up network in the base lead of the transistor. A step pulse is seldom realized, especially when high speed is encountered. The rise and fall times of the input waveform more closely follow a ramp function. Generalized expressions for switching times for such a case have been obtained using charge-control concept. The experimental results were found to be in good agreement with theoretical results.

Transient response study of transistor-tunnel diode hybrid combinations

A tunnel diode has the advantages that it switches very rapidly, responds to the pulses of very short duration and

small energy, and may be used in a stable, monostable and bistable states. The transistor on the other hand has the advantages of operating at appreciably higher voltages and provides isolation between input and output. The combination of tunnel diode and transistor in circuit exploits the merits of both the devices. Taking the merits of both the devices, different possible combinations of tunnel diodes and transistors have been studied.

An approach is suggested for studying the transient behaviour of transistor tunnel diode hybrid combination with resistive feedback which shows an improved switching speed. The study was done by using the charge-control model of the transistor and empirical power functions for the tunnel diode, and the theoretical results were experimentally verified.

In one of the hybrid combinations of tunnel diode and transistor, when a tunnel diode is put across the collector and emitter of a transistor, the circuit works as binary counter. Simplified design procedure and less component configuration are the special features of the binary counter. This particular binary is expected to work up to very high frequency when used with very high frequency transistors.

The other possible combinations which have been studied are: (i) transistor-tunnel diode hybrid combination (tunnel diode connected across the emitter and the base of the transistor); (ii) transistor-tunnel diode hybrid combination (tunnel diode across the collector and the base of the transistor); and (iii) a monostable multivibrator designed using the hybrid combination of transistor and tunnel diode.

The switching behaviour of the epitaxial planar and gold-doped switching transistor is being studied.

Nonlinear Equations and Special Theory of Relativity

Studies made on selected problems in (i) relativistic nonlinear field equations and systems of elementary particles and (ii) special relativity, by Shri M. Lakshmanan, a CSIR research fellow,

under the supervision of Prof. P. M. Mathews, Head of the Department of Theoretical Physics, University of Madras, Madras during October 1970-August 1973, have led to the solution of some complex problems in these fields and lent support to the recent propositions on particles moving faster than light.

Exact analytical solutions of field equations could not be obtained in the case of interactions of elementary particles and these were solved by various approximation techniques. But in the quantum field theoretical problems one encounters the serious difficulty of divergence of perturbation series. Then the main problem boils down to the study of these field equations by non-perturbative methods to understand the nature of the elementary particle interactions obeying these equations of motion.

With this in view, a systematic study of several nonlinear c -number fields and their plane-wave solutions was made. In the case of $\lambda \phi^4$ and other polynomial interactions various elliptic function wave modes were evaluated and the peculiarities were analyzed. A significant result of the study is that the field energy has singularities at finite amplitudes when $\lambda < 0$. Such studies were also made for nonpolynomial and derivatively coupled interactions. One such model, which is the isoscalar analogue of a chiral SU (2) \otimes SU (2) Lagrangian, contains simple harmonic elementary wave solutions, and its single particle analogue was found to possess unusual oscillatory properties. The propagation of these waves for both nonlinear and non-polynomial interactions was studied by making use of the Whitham's theory of nonlinear water waves, and the corresponding group velocity problem was also solved.

Simple approximate quantum energy level formulae for the anharmonic oscillators with anharmonicities ρx^6 and $\lambda x^4 + \rho x^6$ useful from the practical point of view were also worked out. The non-polynomial oscillator with derivatively coupled interaction whose

Lagrangian is $\frac{1}{2} (x^2 - kx^2)/(1 + \lambda x^2)$ was also solved exactly following analytical methods and found to possess interesting analytic properties. Its three-dimensional version was also solved by a group theoretical method.

In special relativity, the problem of the apparent visual shapes of fast moving objects was studied. Several earlier misconceptions were clarified and analytical and qualitative methods were worked out to find the apparent relativistic shapes. It was also found that the apparent velocity of relativistically moving objects may well exceed the velocity of light, a fact which explains the unusual high speeds of certain quasi-stellar objects observed recently.

PATENTS ACCEPTED

Indian Pat. 132237

Method of making gypsum plaster retarder
C. A. Taneja
CBRI, Roorkee

Gypsum plaster or plaster of Paris sets fast when mixed with water and does not allow sufficient time for mixing, casting or plastering on walls. The usual type of retarder being used till now in India for prolonging the setting time is animal glue. This retarder has the drawback of being hygroscopic.

The process covered by the patent relates to the production of an improved and cheap type of retarder which can be used with plaster for casting boards and for plastering walls. The process consists in hydrolyzing horns and hoofs of cattle with caustic soda solution under steam pressure in the presence of an alkaline earth hydroxide, drying and grinding the material. The retarder thus produced is more efficient than gelatine, is nonhygroscopic and is stable on aging.

Indian Pat. 131843

Coconut husk chipping machine
J. P. Kaushish
CBRI, Roorkee

Synthetic resin adhesives account for nearly 50% of the cost of particle boards produced in the country. A very substantial reduction in cost can be achieved by making particle boards from the husk of mature coconuts since

the particles of the husk have self-bonding property. While breaking down the coconut husk into small chips (which are later hot-pressed into a board) the pith should remain intact with the chips because it is the pith that provides self-bonding property to the chips. As the chipping of husk without the separation of pith cannot be done on the usual wood chippers, a special machine (patent under reference) has been developed. The machine has been extensively tried and the chips cut by it form good boards.

The machine comprises two main sub-assemblies, viz. feeding head and cutting head. The feeding head is used for feeding the husk under the pressure of feed-rolls to the cutting head which cuts the husk into chips. The husk, before being fed to the machine, is cut into smaller pieces of about 60 mm length on a band saw or a circular saw. The pieces are fed manually at the input end of the feeding head wherein the husk pieces are straightened and pressed between a number of feed-rolls. These feed-rolls push the husk pieces to the cutting head through an outlet (spout) at the other end of the feeding head.

The cutting head carries a number of disc cutters with knife-edge, which apart from rotating on their respective shafts, have a planetary motion just in front of the feeding head such that the column of pressed coconut husk emerging out of the outlet spout of the feeding head is sliced into clean chips without the pith being separated.

The chipping machine is operated by a single individual. The output of the machine varies widely because of manual feeding but an average output of about 40 kg of chips per hour can be achieved. The electric power required is 5 hp. [See also *CSIR News*, 23 (1973), 65].

Indian Pat. 131422

A new process for dewooling of sheep skins and unhairing of goat skins

S. C. Nandy & Y. Nayudamma
CLRI, Madras

Hair or wool is to be removed from skins and hides during leather processing, and the method adopted for

unhairing/dewooling depends on the value of wool or hair. Sheep skins and, to some extent, goat skins are thus dewoolled or unhaired by a hair-saving process, and cow and buffalo hides are unhaired by hair-destroying processes. In India woolly sheep skins are dewoolled by the 'sweating' process in which unhairing is due to bacterial action. Though the quality of wool produced by this process is very good, the quality of the skin/pelt is considered to be very poor because of severe microbial deterioration of skin. Lime sulphide paint is used by fellmongers in some countries to dewool sheep skins, but the quality of wool is degraded by this method. Unhairing of skins by the application of enzyme preparations has also been advocated but the enzymatic unhairing processes are not always uniform in action as they depend on the thickness and type of the skin. Moreover, it is not possible to extend the specified period if unhairing is not completed in time as skin quality may be affected due to bacterial hydrolysis.

The invention covered by the patent under reference is a new process of unhairing/dewooling by adopting which quality wool/hair as well as quality skin/pelt can be produced. This process is based on a new mechanism by which the autolytic enzymes present or produced in the skin cause the dewooling/unhairing of skin. Bacterial action on the skin is, however, completely prevented for a reasonable period of time. No enzyme preparations are used in this process.

The process is simple and requires no additional equipment or space. Wet-salted skins are washed and soaked well to remove the salt and then treated with the new unhairing agent in a pit for 24 hr or in a drum for 4 hr at room temperature (25-40°C, optimum 37°C). The skins so treated are horsed up to drain out excess water and are kept in a pile for a period of 48 hr. The skins are then ready for unhairing. Dewooling/unhairing operation may be done either by plucking or by using a blunt

knife. If unhairing is delayed the skins are simply left in the pile for a day more. Even if the skins are left in pile for 4 or 5 days there is no risk of skin putrefaction taking place.

Wool/hair may be washed with water and then dried. Dewoolled/unhairs skin is also washed well with a few changes of water and is then preserved or processed further. Unhairs skins may be cured by brining them with saturated salt solution, or the skins may be preserved in pickled state. The disposal of the tannery effluents may be made easy by subjecting unhairs/dewoolled skins to proper swelling and plumping by an alkaline treatment and then to deliming and conventional processing. Skins fellmongered by this process may be converted into improved types of leather.

Indian Pat. 131774

Improvements in the process of making multiple prints of a document with an electrophotographic machine

P. C. Mehendru, D. C. Parashar, G. D. Sootha, Devendra Singh & Narendra Kumar
NPL, New Delhi

The process of making multiple prints from the developed image of a document on the photoconductive plate consists in transferring the total toner particles sticking to the photoconductive plate onto more than one sheet of paper. The prints obtained by the method in vogue do not contain equal amounts of toner particles on them and hence all the prints do not look equally bright.

The process covered by the patent enables us to divide the toner powder sticking to the photoconductive plate into about six parts, transferring almost equal amounts of toner image into different sheets of paper and thus obtaining prints of almost equal brightness. The process of dividing the toner particles into six equal parts consists in changing the grid potential of the charging system by introducing different resistances between the grid and the photoconductive plate during the print-making process and every time before removing the print from the photoconductive plate, charging the

print to opposite polarity and hence bringing back the loosely bound toner particles from the print to the photoconductive plate.

If the object bears a good contrast, more than six prints can be obtained by this method.

PATENTS FILED

2042/Cal/73 : Improvements in or relating to the manufacturing process of versatile aluminium/alloy aluminium conductor for multifarious electrical applications, R. Kumar & M. Singh—NML, Jamshedpur.

2044/Cal/73 : Improvements in or relating to etching of aluminium or its alloys for use as electrodes in aluminium electrolytic capacitors, B. A. Shenoï, K. R. Narasimhan, V. Lakshminarasimhan, (Miss) S. Vijayalakshmi & (Miss) L. Sivaswamy—CECRI, Karaikudi.

2072/Cal/73 : A process for the manufacture of casting pit refractories of bloating type, N. R. Sircar & R. Sinha—CGCRI, Calcutta.

2094/Cal/73 : A process for making sodium hydrosulphide, M. C. Das, S. N. Dutta & M. S. Iyengar—RRL, Jorhat.

PATENTS SEALED

127236 : A process for the production of a fungal acid protease for use, e. g., as a bating agent in leather manufacture, A. Thangamani, R. K. Ghosh & P. K. Goswami—IEM, Calcutta.

127269 : Improvements in or relating to the manufacture of twisted waveguides and jigs thereof, J. Singh, F. Singh & R. C. Kumar—CEERI, Pilani.

127322 : An improved log periodic dipole antenna for beam compression and gain improvement, M. D. Singh & S. P. Kosta—CEERI, Pilani.

127706 : A power trowel, J. P. Kaushish & B. Dass—CBRI, Roorkee.

128617 : An apparatus for the production of both positive and negative dc voltage, R. Mariodoss & M. S. Iyengar—RRL, Jorhat.

128875 : An automatic temperature controller, S. K. Mangal & R. S. Khandpur—CSIO, Chandigarh.

Obituary

Shri Kamalesh Ray

It is with deep regret that we record the sad demise of Shri Kamalesh Ray, Scientist-in-charge, Division of Scientific & Technical Personnel, CSIR, New Delhi; Shri Ray passed away on 16 November 1973 in New Delhi.

Shri K. Ray (born 12 July 1914) graduated in 1935 with honours in physics and took



his M. Sc. degree in physics in 1937 from the Calcutta University. Starting his research career under the guidance of Prof. M. N. Saha at the University College of Science, Calcutta, Shri Ray worked

on high vacuum techniques, design and development of mechanical and oil diffusion pumps, air-turbine type ultracentrifuge, optical instruments and tidal river models.

Shri Ray was associated with Prof. Saha in initiating the Damodar River Plan in 1943-44. Proceeding to USA for higher studies on a Ghose Traveling Fellowship of the Calcutta University, he took the Bachelor's degree (1947) in civil engineering from the California Institute of Technology, and Master's degree (1948) in civil engineering from the University of Colorado. He specialized in hydraulics, soil mechanics, river control and construction of dams.

While in USA Shri Ray worked on research problems in applied optics under Prof. John Anderson, who was in charge of the Astrophysics Department, on the 200-in. telescope project. Telescope making was his hobby, and his first telescope was reported in *Scientific American* in 1941.

On his return, Shri Ray joined the Damodar Valley Corporation as Executive Engineer in charge of materials testing, research and quality control in the construction of earth and concrete dams.

Shri Ray joined CSIR in 1957 as Officer on Special Duty for the Scientific Personnel Committee and the National Register Unit. Appointed Assistant Director of the Unit the next year, he became Scientist-in-charge of the Division of Scientific & Technical Personnel on 22 November 1963.

Shri Ray published a number of research papers in engineering and physics, covering concrete technology, hydraulics, optics, acoustic and scientific instruments. He also contributed to technical journals several papers and articles on planning, employment, scientific and technical manpower, education and research.

Associated with the Census of India in 1961 and 1971, Shri Ray was responsible for introducing the special enumeration of scientific and technical personnel. The census monograph on Scientific and Technical Personnel based on the 1961 census also stands to his credit. He also served on several expert committees on employment, manpower and brain drain, and represented India in international conferences relating to these fields.

Shri Ray's other activities included writing of popular science articles in English and Bengali—a pastime which fetched him several prizes in this field. He founded the Science Writers' Association. He was the editor of *Technical Manpower* bulletin of CSIR. He also edited for some time *Vijnan Karmee* (the journal of the Association of Scientific Workers of India.) He was also associated with *Science and Culture* as a member of its editorial board.

CSMCRI Research Papers : 1954-72

The Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, has brought out a mimeographed list of the titles of research papers published by the institute during 1954-72. The list contains titles of 523 research papers set out year-wise under: Chemicals; Water desalination; Marine Algae; Sea-water agriculture; and General articles. Enquiries may be addressed to : The Scientist-in-charge, CSMCRI, Bhavnagar 20.



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Shanti Swarup Bhatnagar Prizes for 1970 and 1971 Presented

At a function held at Vigyan Bhavan, New Delhi, on 13 December 1973, Shri C. Subramaniam, Minister of Industrial Development and Science & Technology, presented Shanti Swarup Bhatnagar Prizes for the years 1970 and 1971 to seven scientists and technologists.

Congratulating the prize-winning scientists, Shri Subramaniam said: "Your contribution is not just to Indian science or to Indian technology but in a very real sense to the vast fund of knowledge and skill of humanity as such."

Science knows no national confines, and free access to the ideas and developments elsewhere is a matter of vital necessity. Such international relationship need not be regarded as one of tutelage or dependence. "We have reached a certain maturity and vibrating self-reliance in our capabilities, if

not as yet in actual achievements, in the field of science and technology and can afford to let loose, if I may say so, our scientists and technologists in the international arena in a give-and-take relationship that enriches both the parties." Shri Subramaniam stated that, as the Minister in charge of science and technology, this consideration would weigh fully with his approach and decisions in permitting a free, two-way flow of ideas and concepts, of experiments and results between India and other countries.

Urging the scientists to commit themselves to the task of improving the lot of their fellowmen, the Minister stressed that the bulk of the resources devoted to the development of science and technology, and in particular to the research and development projects in a developing country like India should have direct relevance to

the socio-economic problems. "This is true in a whole range of national problems in food, housing, clothing, transport, fuel, or health", he said. This view, no doubt, implied a special bias in favour of applied science and technology in the use of resources, but this need not be at the expense of more basic research work, the Minister added.

In his welcome address, Dr Y. Nayudamma, Director General, Scientific & Industrial Research, paid tributes to Dr S. S. Bhatnagar, the architect of the Council of Scientific & Industrial Research, in whose memory the prizes were instituted in 1957 for outstanding contributions in science, technology and engineering. Congratulating the recipients, Dr Nayudamma expressed the hope that these distinguished leaders of science would accept the challenge of solving national



Recipients of Shanti Swarup Bhatnagar prizes are seated in the front row (from left) : Prof. P. T. Narasimhan, Dr J. R. Talwar, Dr P. K. Iyengar, Dr M. M. Dhar, Dr O. D. Gulati, Prof. M. S. Kanungo and Dr A. Bhattacharyya

problems and helping the government to bring the fruits of science to the doors of the people.

Shri K. G. Krishnamurthi, Chief, Administration, CSIR, read out the citations (reproduced below). [Two of the awardees—Dr A. K. Maiti and Prof. N. Balakrishnan Nair—were not present on the occasion.]

Citations

Prof. P. T. Narasimhan

The Shanti Swarup Bhatnagar Prize for the year 1970 in chemical sciences has been given to Prof. P. T. Narasimhan, Senior Professor of Chemistry, Indian Institute of Technology, Kanpur, for his outstanding contributions in the field of theoretical chemistry and magnetic resonance.

Prof. Narasimhan has made original and significant contributions in the area of chemical physics, especially quantum-mechanical interpretation of magnetic resonance data for the study of molecular structure and properties. He has also been a successful contributor to the study of principles of chemical bonding, conformation, chemical reactivity as well as electrical and magnetic properties of simple and complex molecules using molecular orbital and valence bond theoretical methods. It would be appropriate to describe his contributions in these areas as those that usher in the era of computer chemistry in this country. He has combined his theoretical abilities with experimental skills also, as evidenced by indigenous fabrication of a number of spectrometers needed in his work. Prof. Narasimhan has established an active and composite research group which draws workers from both chemistry and physics disciplines.

Prof. Narasimhan has a large number of research papers to his credit.

Dr J. R. Talwar

The Shanti Swarup Bhatnagar Prize for the year 1970 in medical sciences has been given to Dr J. R. Talwar, Associate Professor of Cardiothoracic and Vascular Surgery, All India Institute of Medical Sciences, New Delhi, for his outstanding contributions in the field of cold injury.

Dr Talwar has worked over the years in the experimental production of various types of cold injury and in evaluating the efficacy of various drugs and physiologically active substances in the management of cold injuries.

His work has led to some practical ameliorative measures for the prevention and treatment of cold injury.

Dr Talwar is a Fellow of the American College of Surgeons. He was awarded Col. Amir Chand Prize for 1967 for his publication entitled 'Methodology and assessment of experimental cold injuries'.

Dr P. K. Iyengar

The Shanti Swarup Bhatnagar Prize for the year 1971 in physical sciences has been given to Dr P. K. Iyengar, Director, Physics Group, Bhabha Atomic Research Centre, Trombay, for his outstanding contributions in the field of neutron beam research and fast reactor physics.

Dr Iyengar has built up at Trombay a group working on various aspects of neutron scattering, using entirely locally designed and fabricated equipment. In this process, he has introduced widely recognized innovations in experimental techniques for neutron beam research and has made notable contributions to the basic understanding of vibrations of atoms in crystal lattices, internal motions of molecules and magnetic ordering and magnetic interactions in solids. He has also promoted the growth of neutron crystallography and studies on the liquid state using neutrons. He is an acknowledged international authority on research reactor utilization.

Dr Iyengar was also a leader of a team of scientists and engineers who were responsible for the construction of Purnima, India's first fast reactor.

Dr Manojit Mohan Dhar

The Shanti Swarup Bhatnagar Prize for the year 1971 in chemical sciences has been given to Dr Manojit Mohan Dhar, Head, Natural Products Division, Central Drug Research Institute, Lucknow, in recognition of his outstanding contributions in the field of organic chemistry.

Dr Dhar has examined the constituents of a large number of indigenous plants and elucidated their chemistry. In a systematic programme of screening of Indian plants for biological activity, he has uncovered many active constituents worthy of further pursuit and exploitation.

He has achieved significant results in his researches on the mode of action of antibiotics carrying a heterocyclic moiety linked to a peptide sequence.

He has developed a new synthesis of the internucleotide bond involving the use of pyrimidine and purine anhydronucleosides.

Dr O. D. Gulati

The Shanti Swarup Bhatnagar Prize for the year 1971 in medical sciences has been given to Dr O. D. Gulati, Professor, and Head, Department of Pharmacology, Medical College, Baroda, jointly with Dr A. K. Maiti, for his outstanding contributions in the field of pharmacology.

Dr Gulati is widely regarded as an outstanding Indian pharmacologist in the field of autonomic pharmacology. His work on adrenergic mechanisms is widely acclaimed.

Dr Gulati is the author of a number of publications both in national and international journals in the field of autonomic pharmacology.

Prof. M. S. Kanungo

The Shanti Swarup Bhatnagar Prize for the year 1971 in biological sciences has been given to Prof. M. S. Kanungo, Professor of Zoology, Banaras Hindu University, Varanasi, jointly with Prof. N. Balakrishnan Nair, for his contributions in his field.

Prof. Kanungo has distinguished himself in making new approaches to the study of the changes in certain key enzymes of the brain, heart, muscle and liver of the rat in relation to aging processes. Through his work he has been able to identify the changes in the qualitative nature of enzymes, their modulation by various regulators, and induction and repression of their syntheses by hormones as the function of age.

Prof. Kanungo has to his credit a large number of research papers.

Dr Amitabha Bhattacharyya

The Shanti Swarup Bhatnagar Prize for the year 1971 in engineering sciences has been given to Dr Amitabha Bhattacharyya, Professor of Mechanical Engineering (Production Engineering & Machine Tools), Jadavpur University, Calcutta, for his outstanding contributions in his field.

Dr Bhattacharyya has made valuable contributions, both applied and fundamental, in developing cutting tools technology for metal removal. His work has led to new and original ideas in the design of cutting tools and several new types of cutting

tools such as (i) tangential-split modified point drill, (ii) retraced type Kolosov high production tool, and (iii) core drill with clamped inserts. Some of his contributions which are noteworthy are : (i) development of a new ceramic cutting tool material—tantalum nitrate-zirconium diboride—in collaboration with Carborundum Universal, Niagara Falls, and Pennsylvania State University; (ii) design and commercial development of an optoscope for chip analysis in metal cutting research; (iii) stochastic modelling of cutting tools wear; (iv) diffusion wear of cutting tools—the basic modelling; and (v) adhesion wear analysis at temperature-sensitive regions. He has published five books and more than 110 research papers.

Dr Bhattacharyya was awarded Mowatt Gold Medal in 1964 by the Calcutta University. He was given President of India Award by the Institution of Engineers in 1965, Sir R. N. Mukherjee Gold Medal in 1966 and K. F. Antia Memorial Prize for 1970-71. He has been elected Member of the International Institute of Production Research, Paris, and is Fellow of the Institution of Engineers, India.

Dr A. K. Maiti*

The Shanti Swarup Bhatnagar Prize for the year 1971 in medical sciences has been given to Dr A. K. Maiti, Reader in Physiology and Head of the Department of Biochemistry and Biophysics, University College of Medicine, Calcutta, jointly with Dr O. D. Gulati, for his outstanding contributions in the field of physiology.

Dr Maiti is widely known for his work in the understanding of the autonomic and viscerovegetative functions of spinal cord physiology. He has organized and coordinated research in neurophysiology, electrophysiology, and histochemistry with reference to the role of spinal cord in blood pressure and carbohydrate metabolism regulations.

Prof. N. Balakrishnan Nair*

The Shanti Swarup Bhatnagar Prize for the year 1971 in biological sciences has been given to Prof. N. Balakrishnan Nair, Professor of Marine Biology and Fisheries, and Head, Department of Aquatic Biology and Fisheries, University of Kerala, Trivandrum, jointly with Prof. M. S. Kanungo, for his notable contributions in his field.

Prof. Balakrishnan Nair has carried out extensive researches on marine fouling organisms. During the past five years, he has made outstanding contributions to our knowledge of the wood-boring Mollusca, in particular the mechanism of boring of timber by them. He is the leader of an active school of workers on Mollusca at the University of Kerala.

Prof. Balakrishnan Nair has to his credit a large number of research papers and publications.

BITM Celebrates 500th Anniversary of Copernicus

The 500th birth anniversary of Nicolaus Copernicus was celebrated by the Birla Industrial & Technological Museum (BITM), Calcutta, from 7 to 11 November 1973, in collaboration with the Consulate of the Polish People's Republic, the Indian Association for the Cultivation of Science, the Birla Planetarium and the University of Calcutta. The celebrations included exhibition on astronomy through ages, exhibition on history of space flight, students science seminar on discoveries

in astronomy, talks on science topics, sky observation through astronomical telescope, and film shows.

At the exhibition, inaugurated on 7 November, Shri Mrityunjay Banerjee, Minister of Education, Government of West Bengal, was the chief guest, and Dr R. V. Karandikar, Professor of Astronomy, Osmania University, Hyderabad, was the president. Prof. J. V. Narlikar delivered a key-note address on 'Copernicus and modern astronomy'. In his welcome address, Shri A. Bose, Director of CSIR Museums, pointed out the special significance of the celebration. Mr Henryk Szczukowski, Consul for the Polish People's Republic in Calcutta, spoke on the life and works of Nicolaus Copernicus.

The exhibition on astronomy traced the development of astronomy from the ancient times and covered a period of about 4000 years. The works and achievements of ancient Indians, Egyptians, Greeks and Arabs were depicted through photographs. The main attraction of the exhibition was the 33 posters lent by the Polish Consulate on the life and works of Copernicus.

NML Regional Liaison Centre set up in Calcutta

The National Metallurgical Laboratory (NML), Jamshedpur, has set up a Regional Liaison Centre in Calcutta to bridge the 'communication gap' between NML and the industry. This

centre will apprise industrialists and entrepreneurs of the scope of technical assistance which NML can offer for setting up new mineral-based and other metallurgical industries. Housed at



A sectional view of the newly set up NML Regional Liaison Centre at Calcutta

*Absent on the occasion

the India Exchange Place the liaison centre exhibits the products and processes developed by NML. The space for the centre has been made available free of charge by the Indian Chamber of Commerce, Calcutta.

As a first step to make the members of the Indian Chamber of Commerce and other industrialists/entrepreneurs aware of this centre, a press conference, addressed by Prof. V. A. Altekar, was held on 5 November 1973. This was attended by about 45 press representatives, besides the officials of the Press Information Bureau of the Government of India. The formal inauguration of this centre is proposed to be held in January 1974.

Speaking on the occasion, Prof. V. A. Altekar, the Director, threw light on the exploitation of some of NML processes. He particularly laid stress on the vast raw materials resources of the eastern region, comprising West Bengal, Bihar, Orissa, etc., for starting new engineering and metallurgical industries.

Some of the major facilities which NML has already established in West Bengal are: field station at Howrah and marine corrosion research station at Digha, besides a number of other major industrial projects which have been successfully completed both for

public and private sector enterprises. Elaborating on the facilities in West Bengal, Prof. Altekar made a special reference to the field station at Howrah which has already served several foundries by rendering technical assistance in planning and development and testing of sand samples, and enabled the production of quality castings. He also mentioned some of the processes for which commercial plants have already been started in West Bengal, such as bright nickel plating of cycle rims and carbon-free ferro-alloys. Based on NML's work, new units in respect of aluminium conductor, extra-fine non-ferrous metal powder, production of steel in basic lined side converter, synthetic cryolite, zinc dust, etc. are expected to be established shortly in Calcutta. Prof. Altekar made special mention of the development of a highly ductile electric grade aluminium conductor, which was conceived and developed in the laboratory and subsequently produced on tonnage scale in collaboration with industry for industrial evaluation.

The Director called upon the interested industrialists to come forward and make use of the expertise and know-how developed by NML for making the country self-reliant in metallurgical know-how.

Utilization of Lignite from Panandhro : CFRI Project Report

The Central Fuel Research Institute (CFRI), Dhanbad, had taken up a feasibility study on the utilization of lignite deposits of Panandhro (Kutch Dist., Gujarat) at the instance of the Gujarat Mineral Development Corporation (GMDC). The study has been completed and the findings (running into five parts) have been made available to the authorities.

After characterizing the lignite (Part I), CFRI studied the feasibility of production of smokeless domestic fuel by various methods (Part II). The consumer acceptability of the briquettes prepared by the method adopted at Neyveli but under higher pressure was considered doubtful because of high production cost due to (i) large capital investment required for the set-up, and (ii) high sulphur content of fuel produced. But 'formed coke' briquettes prepared by a variant of the CFRI method, it has been stated, may prove to be an acceptable domes-

tic fuel both cost-wise and quality-wise.

Power generation using Kutch lignite was subsequently examined in detail. The Rann of Kutch is an arid region and it is not easy to locate a site which has the advantages of proximity to suitable water and fuel sources. However, if power could be generated, it could be transmitted easily.

There is an additional problem with regard to the quality of the lignite, for, unlike the Neyveli lignite, the Panandhro lignite not only has low-melting ash (which makes conventional dry bottom pulverized fuel firing inapplicable) but also high alkali content and sulphur, which may lead to considerable fouling of boilers.

After carefully considering the problem of power production (Part III), two alternatives have been suggested: (1) a slagging type of cyclone-fired

furnace for boiler with modifications and precautions against fouling by evaporating ash constituents; and (2) a process in which the lignite is first briquetted and then gasified with air, power being generated from combustion of the gas (under pressure), coupled with gas turbine driven by the exhaust gases from the combustor.

On the basis of foreign cost data corrected for Indian conditions, it appears that for a power plant at mine head the combined cycle operation based on lignite gasification could be a cheaper route, apart from other potential benefits to power generation in Kutch.

A third alternative, viz. combustion in a fluid-bed, was also studied and experiments were carried out at CFRI, which demonstrated the feasibility and economic advantages of the process for application to Kutch lignite. However, such a process has not been recommended as there is no commercial prototype as yet in operation anywhere in the world, whereas the other two alternatives are established practices in developed countries. The final decision will however depend on extraneous inputs, especially water, possibility of settling workers in an inhospitable region, and costs of mining lignite, besides other considerations mentioned above.

In Parts IV and V, additional information on mineral deposits in and around Panandhro has been reported. A sizable deposit of siderite was found, which proved to be a suitable substitute for imported spathic iron ore for hydrogen generation. Plant trials are in progress in a large commercial organization in Bombay. Limestone of suitable quality for cement manufacture was also found to occur in sizable quantities.

Utilization of High Magnesia Limestone in the Manufacture of Cement : CRI

This is the title of a special publication (SP-6-73), issued recently by the Cement Research Institute of India (CRI), New Delhi, in continuation of the review report brought out in 1969. The utilization of high magnesia limestone in the manufacture of cement is one of the most important R & D projects receiving the attention of CRI.

The publication (pages 34) under notice takes into account all the

aspects of the magnesia problem, such as magnesia unsoundness, current permissible limits of MgO, mineralogy of high magnesia clinkers, properties of stabilized high magnesia cements, large scale trials and plant studies. An important conclusion of the studies so far made is that the safe limit of free MgO content in portland cements produced commercially by clinking techniques (at 1400°C) is 6%.

The report also gives tentative recommendations on the utilization of high magnesia limestone in the manufacture of cement. To utilize marginally high magnesia limestone available in the vicinity of the existing cement plants in India, the safest method would be to blend such stones with high calcium stones so as to keep MgO in portland cement clinker below the permissible limit of 6%. If high calcium limestone is not available within an economic distance, or when exploitation of high magnesian limestone deposits is necessitated due to special reasons, then raw meal proportioning should be done in such a manner that the proportions of C₃S, C₂S, C₃A and C₄AF are the same as those obtaining in ordinary portland cement; the charge might be fired at a clinking temperature of 1450° ± 50°C so as to produce a portland cement clinker, preferably with a C₃S content of about 50% and free MgO of not more than 10%. The clinker thus produced should be admixed with an optimum amount of a siliceous additive, e.g. blast furnace slag, pozzolana, or fly ash. Standard specifications for a cement of such type should be evolved.

The report also recommends that further researches may be directed towards finding solutions to the technical and technological problems in the utilization of such magnesian stones which would yield cement clinker with a free magnesian content of more than 10%. This is considered necessary as India might have to use such limestones at a later date. Manufacture of high magnesia cement by fusion techniques needs attention. Also, the possibility of producing a sound, high magnesia clinker by incorporating SO₃ in clinker in optimal dose either from high sulphur fuel or CaSO₄ addition, the report recommends, deserves special mention.

Enquiries regarding the publication may be addressed to: The Director,

Cement Research Institute of India, M10 South Extension II, Ring Road, New Delhi 110049.

Handbook for Design of Slabs by Yield-line and Strip Methods

The Structural Engineering Research Centre (SERC), Roorkee has published this handbook, compiled by one of its scientists Dr S. N. Shukla. Yield-line and strip methods of designing slabs are comparatively new to India.

Slabs comprise about half of all reinforced concrete structural components; yet the current design practices in the country concerning slabs are among the most conventional. Slabs were being designed in the past by moment coefficient method based on the elastic theory. Tests have, however, shown that such slabs are over-safe and hence the method is wasteful. On the other hand, the ultimate strength methods — the yield-line and the strip methods — give under-reinforced sections, and hence lead to considerable savings in steel. As the slabs designed by these methods are under-reinforced, they may show excessive cracks and deflections even at working loads. Designers would do well not only to obtain a slab section, which is flexurally strong enough to carry the design load, but to see that the slab satisfies serviceability conditions like cracking and deflection.

Part I of the handbook, comprising Chapters 1 to 4, deals with Johansen's yield-line theory. Chapter 1 discusses the basic principles of the yield-line theory. Chapter 2 is mainly based on the recommendations for the design of slabs given in CUR (Dutch) Report No. 26A. Chapter 3 gives formulae and tables for use in design by the yield-line method, and Chapter 4 gives a few worked-out examples.

Part II deals with Hillerborg's strip method and covers another four chapters. The basic principles of the simple method, which is used for the design of two-way slabs with different boundary conditions, are given in Chapter 5. Recommendations and design examples constitute respectively Chapters 6 and 7. The last chapter concerns the advanced strip method, which was developed at a later stage by Hillerborg to deal with slabs with column supports. Several worked-out examples and tables are included in the handbook in order to help designers who are not familiar with these methods.

Enquiries regarding the handbook (royal 8vo; 180 pages; price Rs 15) may be addressed to Shri N. Jayaraman, Head, Information Division, SERC, Roorkee (U. P.).

Crystal and Molecular Structure of *o*-Dimethylaminobenzoic Acid

The crystal and molecular structures of *o*-methylaminobenzoic acid and *o*-dimethylaminobenzoic acid have been determined by X-ray diffraction in order to study the effect of the substitution of methyl group on the structure of anthranilic acid. The studies were made by Shri N. N. Daneshwar at the National Chemical Laboratory, Poona, under the guidance of Dr L. M. Pant of the laboratory. It has been found that the molecules of *o*-methylaminobenzoic acid exist as neutral molecules in the crystal, whereas *o*-dimethylaminobenzoic acid exists in the form of zwitterions. There is a very strong intramolecular NH—O hydrogen bond in *o*-dimethylaminobenzoic acid in which the N—O distance is 2.50 ± 0.01 Å.

Shri Daneshwar was awarded Ph.D. degree by the Poona University for his thesis relating to the studies.

PROCESSES AND PRODUCTS READY FOR COMMERCIAL UTILIZATION

Fluidized-Bed Furnace for Exfoliation of Vermiculite

Vermiculite, a naturally occurring mineral, exfoliates several times its original volume on heating, and yields a light-weight material with high thermal insulation and sound absorption properties. A fluidized-bed furnace has

been developed by the Central Building Research Institute (CBRI), Roorkee for the manufacture of exfoliated vermiculite.

The main use of the product is as a thermal insulating material. For this purpose it is used as such in the form of loose fill or as boards and blocks by incorporating suitable binders. It is

also used for making hot face insulating refractory bricks which can withstand temperatures of the order of 1000°C, as a light-weight aggregate for thermal insulation and acoustical plasters, as a fire-proofing agent, as a material for electrical insulating paper, and as a filler in paints and rubbers, etc.

There is a constant demand for light-weight insulating materials, which is likely to increase further with the availability of cheaper materials. If exfoliated vermiculite could be produced at much lower rates, the demand for the material is bound to increase with the general growth of the industry and building construction.

Reserves of vermiculite are reported in Andhra Pradesh, Tamil Nadu, Bihar, Madhya Pradesh, Karnataka, Rajasthan and West Bengal. Furnace oil or light diesel oil, which is used as a fuel, is readily available in the market. The fluidized-bed furnace can be used for exfoliation of vermiculite of any origin and the bulk density of the product will depend on the variety of the raw material.

The raw material of required size costs between Rs 125 and 145 per tonne at mines. Exfoliated vermiculite is sold at about Rs 900 per tonne.

The institute has designed and built a furnace with a production capacity of 120 kg per hour. The furnace has been successfully tried several times for producing several tonnes of exfoliated vermiculite. Detailed design and engineering data for a fluidized-bed furnace with a production capacity of about 860 tonnes per annum will be supplied by the institute.

The yield of exfoliated vermiculite is of the order of 90% by weight of the raw vermiculite (dry).

The capital investment required for the project is estimated at Rs 1.67 lakh. The cost of production per tonne of exfoliated vermiculite is about Rs 510.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024

Zinc Chromate Primers

Zinc chromate primer in epoxy ester linseed oil, modified phenolic stand oil or linseed alkyd plus phenolic hardener can be used on all types of steel structures as well as on structures consisting of both ferrous and nonferrous

parts, e. g. bridges, towers, tanks, sheds, poles, bus bodies, and aircraft parts.

This primer is not used in India at present for steel structures. Other primers such as red oxide, red lead, and red oxide-zinc chromate are being used currently. Assuming that the primer paint amounts to one-eighth of the paint products produced in the country, the annual consumption of this primer is 10 000 tonnes, valued at Rs 100 million.

Zinc chromate pigment (conforming to IS : 51) is mixed with one of the vehicles mentioned above, in a porcelain mixing jar. A small amount of solvent is added and iron balls ($\frac{1}{2}$ in. diam.) are introduced and ground till the Heghman scale reading comes to 5-6. The balls are then removed and the remaining quantities of solvent and vehicle are added to adjust the consistency of the paint.

Five litres of the paint have been prepared using a rotating jar mill in each batch, and 40 litres of the product have been produced.

Field trials carried out at exposure yards situated in Karaikudi, Mandapam Camp, Mangalore harbour and Madras harbour have testified to the superior performance of the product compared to the performance of the presently used primers for a period of two years.

Zinc chromate and suitable vehicles are the raw materials required, and all are available indigenously.

Ball mill, three-roller mill with jar, Heghman gauge, Stormer viscometer and other testing equipments, stainless steel vessels and mixing tanks are needed.

A plant producing 135 tonnes per year, or 450 kg/8-hr day, will require a capital investment of Rs 3.70 lakh, including a working capital of Rs 2.63 lakh. The cost of production on this scale works out to Rs 7.35 per kg.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Bostik Sealant Substitute

Bostik compounds have excellent adhesion to metals and are used specially for sealing pressurized cabins and integral tanks of aircrafts. These compounds are mostly consumed by defence organizations. Precise data

about the demand of the product in the country are not available, but it is reported that the Hindustan Aeronautics Ltd (HAL), Bangalore are using about 1400 kg of this material annually. The country's demand is likely to grow in future. It is estimated that the present total defence requirements may amount to about 2250 kg per annum.

With a view to making the country independent of the import of this strategic material, investigations were undertaken at the National Chemical Laboratory, Poona, and a process for the manufacture of the sealants was successfully developed. Based on NCL know-how, a firm is producing the sealant. The process consists in the preparation of RPFN resins, milling rubber with other ingredients and then dissolving in the solvent along with the RPFN resins. The finished product (prepared on 70 kg per batch) was tested by HAL, Bangalore and found to withstand the specified functional tests.

Phenol, formalin, resorcinol, oxalic acid, nitrile rubber, rubber chemicals and solvents are the major raw materials required for the manufacture of the sealant. Except nitrile rubber, all the raw materials are indigenously available. Nitrile rubber would also be shortly available in the country when the firm which has been licensed the NCL process goes into production. All-glass, stainless steel or glass-lined equipment are required and these can be got fabricated by local manufacturers. The optimum capacity of an economically viable unit is assumed to be 15 000 kg per annum. The total capital outlay for a plant of this size is estimated at Rs 2.3 lakh (Rs 1.2 lakh as fixed capital on plant and building, and Rs 1.1 lakh as working capital). However, considering the present demand of 2250 kg, it is assumed that the plant will work only for 45 days to produce these adhesives, and for the rest of the year the facilities will be utilized for producing allied products. Proportionate allocation has been made with respect to cost elements pertaining to equipment, land, building, labour, etc. The ex-factory cost of production works out to about Rs 19 per kg as against a selling price of about Rs 25 per kg.

Further particulars may be obtained from: The Managing Director, National Research Development Corpo-

ration of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

Water Level Controller

A simple device for maintaining a constant head of water in air coolers, washing machines, etc. has been developed by the Regional Research Laboratory, Jorhat. The device can be used in process control equipments also. It can be used for maintaining foam levels also.

The device consists essentially of two transistors with an electromagnetic relay with two electrodes. When water comes in contact with the conducting electrodes (probes), the relay connected to the transistor circuit is energized, which in turn operates a solenoid valve. The unit can be operated on mains or battery. When direct-current operated solenoid valves are directly used, the relay can be eliminated and the unit would be cheaper. Prototypes have been fabricated by the laboratory, and these are working satisfactorily.

The laboratory has proposed that the capacity of an economically viable unit is 1500 pieces per annum. The main components required for the fabrication of the device are AVO meters, transistors, relays, wires and batteries. The total outlay for a unit of such capacity is estimated at Rs 60 000 (Rs 50 000 being working capital towards three months' requirements of raw materials and labour charges). The cost of production is estimated at Rs 85 per unit and profitability is high.

Further particulars may be obtained from: The Managing Director, National Research Development Corporation of India, 61 Ring Road, Lajpat Nagar III, New Delhi 110024.

PATENTS ACCEPTED

Indian Pat. 131057

Improvement in or relating to a radiant heating platen for freeze-drying plants or other driers using radiant heating
B. C. Mohanty & A. Parida
RRL, Bhubaneswar

Radiation is an effective mode of heat transfer to foodstuffs or other substances being dried. In this technique drying occurs under controlled atmospheres, as in freeze-drying or similar drying operations where conduction and convection heat transfer have their limitations. Generally, radiant heat is supplied from a heating platen which is heated by circulation of a hot fluid or by electrical means. Important considerations for a successful design of

a radiant heating platen are: maximum heat transfer, uniform surface temperature, efficient circulation arrangement for hot fluid, and convenient supporting system for the platen.

The radiant heating platen covered by this patent comprises a heating coil or steam coil of square or round section, which is given a number of U-bends, placed in a horizontal plane. The platen can be kept hung between the drying trays as the U-bends are tangentially welded to a horizontal support. Two cover plates made of high emissive materials are fastened at the top and bottom of the coil. The space between the coil and cover plates is packed with metallic foils of high conductivity, and consequently heat conduction from the circulating fluid to the radiating surface is accelerated and a uniform temperature is maintained over the surface.

Such a platen is light and simple in construction and the cost of production is low in comparison to that of conventional solid platens.

Indian Pat. 130788

Lead chloride water-activated cell system
K. Dakshinamurthi & P. B. Mathur
CECRI, Karaikudi

The battery system covered by this patent is a recent addition to the family of water-activated batteries. Magnesium-cuprous chloride and magnesium-silver chloride systems are now commercially manufactured in the halide type of activated batteries. Magnesium-silver chloride battery is expensive and magnesium-cuprous chloride system has poor shelf-life. Magnesium-lead chloride battery has the dual advantages of cheapness and stability. The battery system operates between 1.0 and 0.8 V at various current drains, and is capable of high rates of discharge at as high as 90% cathodic material efficiency. Compared to cuprous chloride, which gets oxidized to the cupric state, lead chloride is highly stable. This property of the cathodic material imparts long shelf-life to the battery system.

A high voltage pack of 110 V assembled employing the cell system operates at an extremely steady voltage for 3-4 hr, satisfying the requirements of radio-sonde power pack required by the Meteorological Department. The system may find many applications in meteorological, naval and space equipment. The fabrication of the battery is simple from the engineering point of

view. The system holds out promise of immense practical application. Batteries of wide ranges of voltages and capacities can be fabricated in this system.

Indian Pat. 130472

Electrodeposition of shellac from aqueous systems
S. Guruswamy, S. I. Krishnamoorthy & V. Yegnaraman
CECRI, Karaikudi

The invention covered by the patent concerns a process for obtaining shellac electro-coatings over mild steel, brass and zinc. Coatings of various shades ranging from golden yellow to pale green to brown to reddish brown to black can be obtained. The process consists in: (i) dissolving shellac in isoamyl alcohol by gentle heating, (ii) neutralizing the free acid groups in the shellac by the addition of triethanolamine in small quantities; (iii) solubilizing the neutralized solution in water to form a colloidal system; and (iv) electrodepositing shellac over a metal from the colloidal system by employing direct current in the 20-200 V range.

The properties of electrodeposited shellac are modified by the heat treatment in air of the electro-coated articles in 120-260°C temperature range for a period of 30-100 min. Varying shades can be obtained by using different metals and different grades of shellac, and by varying electrical conditions of deposition, the time and temperature of baking of the electro-coated samples. For example, glossy black deposits can be obtained by the addition of bitumen to shellac and baking the coated articles at comparatively low temperatures.

Excessive heating of the bath at higher voltages adversely affects the formation of shellac electrocoats of desirable quality. This can be prevented by adding small quantities of mercaptobenzothiazole to the electrodeposition bath.

Organic coatings can be made with speed and ease without damage to the metal coated. The process can be easily adapted to function as a continuous coating process for metallic articles of interest to commerce and industry which need an organic coating for purposes of corrosion protection, electrical insulation and decorative applications.

An earlier invention by the same patentees (Indian Pat. 129510) relates

to the electrodeposition of linseed-maleic acid resin systems on mild steel [CSIR News, 23 (1973), 99].

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1998/Cal/73 : An apparatus and improvement in or relating to chemically thinning and polishing semiconductor wafers, R. P. Gupta, W. S. Khokle & J. P. Pachauri—CEERI, Pilani.

1999/Cal/73 : Improvements in or relating to the boundary layer flowmeter, H. Singh—CEERI, Pilani.

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2093/Cal/73 : Utilization of recuperator waste from asbestos cement factories for making flooring tiles, U. N. Sinha & M. S. Iyengar—RRL, Jorhat.

2144/Cal/73 : Improvements in or relating to fertilizer cooler, A. Basu & K. S. Narasimhan—RRL, Bhubaneswar.

2115/Cal/73 : A process for production of a new antiviral substance (designated 6-MFA) from a strain of *Aspergillus flavus*, R. Maheshwari & B. M. Gupta—CDRI, Lucknow.

2116/Cal/73 : A process for the synthesis of 3-(5-hydroxybenzocycloalkenoxy) - 2-hydroxypropylamines, S. N. Rastogi, P. C. Jain, N. Anand, M. P. Dubey, R. C. Srimal, K. Kar & B. N. Dhawan—CDRI, Lucknow.

2177/Cal/73 : A process for making sodium hydrosulphite, M. C. Das, S. N. Dutta & M. S. Iyengar—RRL, Jorhat.

2247/Cal/73 : Improvements in or relating to non-sludge foaming zinc phosphating composition, H. R. Thilakan, K. P. Mukherjee & A. K. Lahiri—NML, Jamshedpur.

2145/Cal/73 : A process for the production of domestic or industrial fuel briquettes utilizing middlings or sinks from caking coal washery or low grade caking coal with or without addition of coke fines, semi-anthracite or natural coke (Jhama), using inorganic binder and without using any organic binder, S. Gupta, P. K. Das, A. K. Sen Gupta, N. N. Chatterjee, A. K. Chakravarti & A. Lahiri—CFRI, Dhanbad.

2176/Cal/73 : Pressure compensating valve for diesel engine, D. P. Nischal—MERADO, Ludhiana (CMERI, Durgapur).

2248/Cal/73 : A process for synthesis of 2- and/or 6-substituted-4a, 11a-cis- and trans-1,2,3,4,4a,5,11,11a-octahydropyrido (4,3-b) carbazoles, S. N. Rastogi, N. Anand, R. C. Srimal, P. R. Dua & B. N. Dhawan—CDRI, Lucknow.

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127798 : Improvements in or relating to the new process for the production of carbon black from coal, M. S. Iyengar, R. Haque, R. K. Chakrabarti, M. L. Dutta & A. K. Singh—RRL, Jorhat.

128876 : A device for gas supply failure alarm, S. K. Mangal & R. S. Khandpur—CSIO, Chandigarh.

130551 : A new process for separation of the dimethyl and monomethyl components from a mixture of dimethyldichlorosilane and methyltrichlorosilane, J. Gupta, C. Gopinathan, (Mrs) S. Gopinathan, M. J. Eapen & P. A. Awadaji—NCL, Poona.

Symposium on Refrigeration and Airconditioning

The third symposium on Refrigeration and Airconditioning is being organized by the Central Food Technological Research Institute (CFTRI), Mysore, at the instance of the Indian National Committee of the International Institute of Refrigeration. To be held at CFTRI in July 1974, the symposium will discuss the latest techniques and researches, designs and developments in the field of refrigeration and airconditioning. There will be five technical sessions besides inaugural and plenary sessions. The technical sessions and the areas of discussion in each session are as follows:

- (1) Cold storage of perishable products — Fruits and vegetables; Meat, fish and poultry; Dairy products; Freezing and frozen products; and Precooking, packing, and refrigerated transport
- (2) Heat transfer and thermodynamics of refrigeration
- (3) Design and construction of cold storages
- (4) Machinery and equipment used in cold and freezer storage
- (5) Airconditioning

Intending participants are invited to present papers on topics indicated above. The last date for receipt of abstracts of papers is 15 January 1974 and that for receipt of full papers is 15 March 1974. The registration fee per delegate is Rs 50.

All correspondence regarding the symposium should be addressed to:

Shri S. K. Lakshminarayana, Convener NSRA, Discipline of Engineering & Maintenance, Central Food Technological Research Institute, Mysore 570013.



CSIR

NEWS

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